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GEOGRAPHY OF THE WAR THEATRE IN THE NEAR EAST.*

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The most obvious geographical facts to be remarked about the present war with Turkey are the immense distances which divide the four areas of operation, and the extraordinary imperfection of their inter-communications. Taking the four as (1) North-Westernmost Asia Minor with South-Easternmost Thrace; (2) North-Easternmost Asia Minor; (3) Southernmost Syria; (4) Shatt el-Arab region, we note at a glance that each area lies, in round figures, about 1000 miles from all the rest. Since one of them, the first, includes the capital, it follows that on three fronts Turkey is fighting a thousand miles or more from the heart of her imperial life. This fact constitutes a disadvantage all the more serious, because, while the Ottoman Empire is singularly ill-equipped with an arterial system, it is more dependent on its heart than, perhaps, any other in the world. That is to say, it is the most centralized both by its theoretic scheme and in its practical working. Why, then, is the heart placed where it is—in one extremity of an area, which, though defective in population (under thirty to the square mile), is spatially among the half-dozen most extensive continuous territories on the globe, which are political units?

In part, Constantinople, as a capital, is a political survival. The Ottoman Empire began its history as a European Empire. Though the Osmanlis coalesced into a State first in Asia—in the extreme north-western corner be it remarked, and almost within sight of Constantinople—they turned their eyes and energies to Europe, transferred their centre of gravity at once to the Balkans, and had conquered an empire there long before they thought of one in Asia. They aimed at the succession to the heritage of Byzantium; and this, in the fourteenth and

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fifteenth centuries, had ceased to include any considerable territory in Asia. When they crowned their efforts by the capture of the Byzantine capital in 1453, this, naturally and inevitably, became their capital.

Later on, in the sixteenth and seventeenth centuries, after an Asiatic Empire, made up in the main of the fragments of the Seljukian and the Saracenic empires, had been added by the Osmanlis to their Byzantine heritage, the capital still proved to be in the most convenient position imaginable. If not quite in the centre geographically, it occupied a point of equipoise between very evenly balanced divisions. For the ratio of political and economic importance to spatial extent was much higher in the European part of the empire than the Asiatic; and, moreover, the Turks still hoped to increase their holding in the former.

Now all is changed. The European Empire has vanished bit by bit; the Asiatic alone remains maintaining a last outpost in Europe. Constantinople has become virtually a frontier city, situated on the fringe of an alien continent, in a remote angle of its empire.

Just, however, for the very reason that their empire began as a European one, as direct heir by conquest of the empire of Byzantium which the Osmanlis called the Empire of Rum (it was itself the heir of Rome), they cannot withdraw their capital to any more convenient geographical spot in what is left to them of empire. For with the prestige of Roman emperors they conquered that empire, and by the prestige of their continued occupation of Eastern Rome they have held it. A Turkish monarch retired to Brusa, Konia, Aleppo, or Baghdad would command no higher place in the imagination and tradition of Asia than once was commanded by the infant Osmanli state, by the Seljuk sultanate, by the Saracenic kingdom, or by the unreal empire of the Abbasids. He would be, in fact, just another Sultan in a continent where sultans swarm.

Nor even could this peril be neglected, would the Ottoman Turks themselves regard security in Asia as any sort of compensation for the loss of an uneasy seat in Europe. Their religion is Arabian, their speech of the Oxus, their social system Central Asiatic, and they owe most of their ideas of government to China and Persia. But these things do not outweigh the fact that they began their imperial existence in the most Europeanized part of Asia, by attaching to themselves the Europeanized peoples of the homelands of Byzantium, and with the single ambition not to be as Seljuks, but to take up the Roman lordship of Europe, and be Europeans. Their Asiatic origin and its inevitable consequences are a weight round their neck which they have been always wishful, but never capable, of detaching. They might have succeeded had they ever found any one to Europeanize their religion; but, unfortunately for them, the one people capable of that feat, the Greek, had already given itself to another Asiatic religion, and was committed to the result of its work, before ever Mohammed appeared in Arabia. Their failure mattered much less in the early centuries of Ottoman Empire, while Central and

Northern Europe had yet to develop consciousness of continental distinction, and were inferior in military and political organization to the Islamic powers of West Asia. But in these latter centuries, when the relation has come to be emphatically reversed, Turkey, standing almost where she was in the sixteenth century, finds, in the twentieth, her imperial capital in a strange world: for, by force of circumstances, not by design, she has become primarily an Asiatic power.

Moreover, it was with men of European birth and Christian origin that she won her empire, held it, and administered it. It is not too much to say that throughout her great imperial age, the sixteenth and early seventeenth centuries, no man of Turkish origin and Moslem birth, outside the royal family itself, was among the leaders of her army or imperial administration. Her generals and ruling officials had all been taken as children from Christian parents in Europe, made imperial slaves for life, and educated as Moslems in the arts of war and government with a thoroughness not dreamed of by Plato. Their offspring, because Moslem born, were barred from succession to the fathers' functions equally with all men of the Turkish race, and had to be content with either religious or non-official life, while new Christian and European children were being recruited, converted, and trained to succeed to the military and civil power. It was one of the most extraordinary systems in all history, and it, and no other, was responsible for the institution of an Ottoman Empire in two continents.

Bit by bit, however, in the seventeenth century it began to break down. Europe grew too strong to allow recruiting of children beyond the strict frontiers of the Ottoman territories which had been drained of their Christian manhood, and the vast body of the Moslem-born, resenting exclusion from the profits and glory of the ruling class, dared to assert itself and gradually obtained the place of power. The Empire declined at an ever-increasing rate as its ruling *personnel* became more and more Asiatic. Men of Albanian, Vlach, Greek, or Slavonic blood on the male side, and a constant infusion of Caucasian vigour from the female side, have delayed the decadence; but it has been continuous and has quickened in the last two generations, which have seen uncontaminated Asiatics—Syrians, Arabs, Kurds—preferred to high office in ever increasing numbers. But despite all this, the desire and ambition of the Turk remains what it was—to be Turkish European and recognized as such, in spite of the Asiatic clog. That is the aim of the Committee of Union and Progress, and the lead in the attempt to realize it has fallen, appropriately enough, in these latter days to Enver, who is reported to be in part Slav.

This is, I know, not strictly geography; but I offer it to explain on the one hand a geographical fact which has great influence on the actual political and military situation, and, on the other, the recent action of the Turks in joining the Teutonic alliance, rather than either our group or no European group at all. Passionately desiring, while remaining Turks

and sovereign, to be accepted into the European comity, they have realized that from the German federation alone they can hope for sympathy and help in their desire, and that the moment of German necessity is the moment to make a supreme effort to obtain it. They do not feel themselves an oriental power, desirous to lead Asia against Europe, or Islam against Christendom, but occidentals, ready to ally themselves with whomsoever of the Christian nations is the most likely to accept them into the comity of Europe. With this paramount object they have entered on the present struggle, cost what it may.

(1) That the Turks have been able to retain their frontier capital in another continent than that in which nine-tenths of their empire lie is due to certain political considerations, but, first and last, to the peculiar geographical environment of Constantinople. Here we have a city situated on the southern extremity of a peninsula, whose landward part is all rough hill country, rising northwards to an isthmus, and there falling steeply almost to sea-level again. A continuous wall of broken shaggy slopes faces Europe, approaching at either end so nearly to sea (at the southern end, to a marine lagoon) that it can hardly be turned without command of that element. This wall, of course, carries the now famous Lines of Chatalja. Its strength has been increased by deliberate policy, which has converted the lands both behind and before into almost uninhabited forest.

A further geographical fact must be noticed. At the northern extremity of this wall the hill-system bends up the coast-line, while southward it develops its highest and most broken relief towards the Black Sea. This high level continues right to the mouth of the Bosphorus, falls steep-to, and again springs up steeply on the further Asiatic shore. That fact will, perhaps, explain why no attempt has ever yet been made to rush Constantinople by landing forces on her Black Sea coast. I need not insist further on the strength of the Chatalja Lines. No one has forgotten how they stopped the victorious Bulgarian army, though defended by only the broken remnants of the first-line army and by emergency levies of second-line troops. They were passed, of course, by the Russians in the Ottoman debacle of 1878; but the forcing of them against any determined defence, and without command of the sea, must always be terribly costly.

The unique geographical difficulties of the sea-approaches are even more notorious. Whether you attack from the Black Sea or the Mediterranean, a narrow channel must be threaded, in the one case nearly 20 miles long, in the other nearly 50. The shorter channel has been made more difficult by nature, the longer more difficult by military art. The course of the Bosphorus is the more tortuous of the two, and its shores are higher on the average, and steeper. It is, in fact, a chain of blind defiles, which have never been forced in modern times, and the single natural condition which still makes attack through them easier than through the Dardanelles

DARDANELLES: THE NARROWS FROM ERENKEUI.

DARDANELLES: ASIATIC SHORE NEAR ERENKEUI.

TYPICAL CHALK COUNTRY IN THE NORTH DESERT OF SINAI.

EUPHRATES RAILWAY BRIDGE IN SPRING, 1914, WITH TWO SPANS IN POSITION, SEEN FROM THE WEST WALL OF CARCHEMISH. BRITISH MUSEUM'S EXCAVATION HOUSE IN THE FOREGROUND.

is the generally favourable direction of the main current. We have reason to know that this has acquired new importance in our day of floating mines.

As for the Dardanelles, its best-known geographical peculiarities are the main current varying in strength according to the width of the passage and the season, but always setting from north-east, and the plague of etesian north-east winds. These have not the same importance now that they had before the invention of steam. But they are not by any means without importance as we have learned within the last few weeks; for it is they that in concert render so effective the defence of the Dardanelles by mines, while the boisterous climatic conditions, caused by the draught from the steppes and the Black Sea being drawn south-westwards and concentrated between the high relief on either hand, have hampered seriously our naval operations. The shore lines of the Dardanelles are, in contrast to those of the Bosphorus, remarkably straight and little indented on either side, and their general direction remains uniform throughout, except for the famous rectangular kink at the Narrows. But the contrary coasts differ considerably in other respects. The Asiatic is, throughout, easy and open, while the European is steep-to, high and rugged for the first half of the passage from the west, offering no good landing-place provided with easy road into the interior of the peninsula till the upper end of the Narrows is reached. All the western end of the Gallipoli peninsula, indeed, is of broken, hilly character, which combines with lack of water and consequent lack of population and roads to render it an unfavourable area for military operations. No general, if he had the choice, would land a considerable force upon it at any spot below the Narrows. On the Asiatic side landing is everywhere easy, and the littoral is open up to the point where the Marmora begins to spread out its waters, closely framed by hills on the south. But, of course, one must reckon with the main hinterland of Asia Minor behind this littoral. It rises soon into the mountainous groups of Ida and the Mysian Olympus, and, from it, if left in hostile hands, a force landed on the Trojan coast would run risks not to be feared on the Gallipoli peninsula.

The command of this *hinterland*, the north-western corner of Asia Minor, one supposed to be the ulterior object of the operations which were begun in the Gulf of Smyrna a good many weeks ago. But whether such, indeed, was and is their object, I know no more than the most ignorant person present, and I will only say this on the matter from a geographical point of view. There is a direct route from Smyrna by way of Manisa and Soma to the Sea of Marmora. Its easiest line is now traversed by a railway, debouching at Panderma immediately to the east of the Cyzicene peninsula. It is obvious that whoever holds this line, about 210 miles in length, can turn the Asiatic defence of the Dardanelles. To hold it securely, however, would probably entail holding also all the land to west of it. This would be a big operation. This corner of Asia Minor, as a whole, though mountainous in its north-western parts, is

EUPHRATES RAILWAY BRIDGE. BRITISH MUSEUM'S EXCAVATION HOUSE IN THE WEST WALL OF CARCHEMISH.

easily penetrated, well inhabited, well watered and fertile. Its western coast is largely in the hands of Greeks (even after the measures taken a year ago to chase them out of the Phokia and Menemen district), and the interior in the hands of an agricultural population which includes many settlements of refugees from the lost Balkan provinces of Turkey. In any case, unless this corner of Asia Minor is held, a layman finds it difficult to believe that the Asiatic shore of the Dardanelles can be secured; or, further, that without a firm hold of the latter, as well as of the Gallipoli peninsula, a fleet can either force a passage to the Marmora, or safeguard its communications when that is accomplished.

The Dardanelles have only once been passed in modern times against active opposition. That was in 1807 in the days of sailing ships. Our fleet then arrived off Constantinople, but in so battered a condition as to be practically powerless to achieve its ultimate object. If the difficulties of beating up against current and wind will not trouble our present attacking fleet, relatively greater difficulties confront it in the waterway from the power and mobility of modern fortress artillery and the dangers from fixed and floating mines and torpedoes launched from tubes ashore. The importance, therefore, of land forces, sufficient to deal with 200,000 good soldiers under German leaders, cannot be over-estimated.

(2) So much for the first and principal theatre of the war. The second lies roughly 1000 miles to the east, and its lines of communication with the first are so lengthy, arduous and ill-equipped that one wonders if the Ottoman armies, which are now operating in the highland region north-east, east and south-east of Erzerum, do, in fact, receive any effective support from the capital of the Empire. It must be remembered, however, that the Turks have more than once maintained a stout struggle for a considerable time against Russia in this same remote region, though never with final success, and that their communications have never been better than they are to-day.

They are, however, very bad at their best. By land, the railway goes no farther than Angora, from which point it is about 500 miles march to Erzerum. The road is a highway of very ancient commerce, which follows the main direction of the relief of northern Asia Minor and meets no very serious difficulties. But it is so long and toilsome that, in times of peace, the sea route to Trebizond has been preferred, since it shortens the land journey to less than 200 miles. These 200 miles, however, are very hard work. The road crosses three main ridges of the Pontic Alps, rising each time over 5000 feet to fall again, and once up to a maximum height of over 8000 feet. Snow-bound nearly half the year, and notorious for the icy gales which sweep its passes, this road is as arduous a line of communication as could well be conceived. It is more than twenty years since I traversed it, but I have not forgotten! How far conditions in the Black Sea at present permit of any steamer service being maintained between Constantinople and Trébizond I do not know.

Erzerum itself lies in a wide upland plain through which the infant Euphrates flows. Elevated over 6000 feet above sea-level, it endures a nine months' winter and is famed as the "Siberia of Turkey." Thence, to the actual scenes of fighting, intervene further stretches of about 100 miles. Lofty passes through the Alpine group, of which Ararat is the culmination, a region of sub-arctic winter climate, with scant population and supplies, where active operations are hardly possible except in late spring, summer and early autumn, have to be crossed. But these passes are in Turkish territory, the frontier having been drawn not on the main water-parting, but some distance east of it. Thus the Ottoman forces were able to penetrate at the first some distance into the lower country on the Russian side, in both parts of this area of operations. I do not know any part of this region at first hand, and am not competent to enlighten you on these operations; but I have an impression that their general object was rather to divert and occupy Russian attention, than to threaten serious invasion. The northern Ottoman column following the Aras valley has pushed into and raided the plateau between Olti and Kars, with an ostensible objective in Kars itself, which commands the Tiflis road. Diverging to the left towards the Black Sea east of the Lazi Alps, they have, apparently, also made demonstrations towards Batum. The southern forces did the same for the plains of Erivan and Echmiadzin and the Persian district of Khoi, from which Russian communications with Tabriz can be threatened. The sudden and now half-forgotten dash forward along this line, which resulted in a momentary occupation of Tabriz itself, probably had a political rather than a military object.

(3) Between the second and third areas the wild mountain land of Kurdistan intervenes and no line of communication at all worth consideration exists. We must hark back to the first area and set out afresh. The communications of the capital with both the remaining areas of war, the third (Sinaitic), and the fourth (Shatt el-Arab), are easier than with the second. The Baghdad railway serves as a trunk line towards both as far as Aleppo; but it is not a continuous line. There are two serious interruptions of the track, where it meets first the Taurus, second the Amanus mountains. Neither of these ranges has yet been pierced. In the first several of the necessary tunnels have not even been begun; and all traffic between rail-head on the north slope and rail-head on the south slope must pass by road over a crest 8000 feet high. A finely engineered and constructed *chaussée*, practicable for the transport of artillery, serves as the link, and can be traversed by light mounted parties in about 10 hours.

The railway serves again in Cilicia, but breaks off once more at the foot of Mount Amanus, which it reaches at two points, near Osmanieh by the main line, and at Alexandretta by a branch. The tunnel, which is to traverse this range, has been driven more than half through; but, for

purposes of actual communication, is, of course, as useless as if not begun. Nor can it be completed within any likely term of this war; for the borers have struck two of the hardest known rocks, quartz and porphyry, in the heart of the mountain, and their daily progress at best has, for a long time, been measured by inches. Road traction, therefore, has had to be resorted to once more, chiefly by the Hassan Beyli track which the German engineers have improved into a fine *chaussée*, to meet their Syrian rail-head above Raju; but also by the better known Beilan road from Alexandretta, which does not, however, hit the Syrian section of the Baghdad railway until more than half of the way inland to Aleppo has been traversed. By both of these roads the Turks have been forwarding men, stores and munitions, and hauling big guns. An Englishman who saw them dealing with the latter on the Hassan Beyli road reports that, under German direction, they were doing their work remarkably well.

From Aleppo, or rather from Muslamieh, a village some ten miles to the north of the city, the main line bears away north-eastwards for the Euphrates. A branch, however, connects with the French-built railway which runs south from Aleppo to Damascus and on without break of rails (though with variation of gauge from Rayak) to the Hejaz line. By this a base can be reached at Maan within 200 miles of the Suez Canal; but these 200 miles lie almost entirely through desert which, at first, is of a very hilly character.

The campaign in the third area is not being prosecuted by the Turks with much energy as yet for various reasons. They cannot spare troops from the first two areas, and the army of 50,000 men or so which they have collected and kept in Syria is drawn largely from their Arab-speaking subjects, who fight half-heartedly, if they fight at all, in any Ottoman quarrel. Syria is disaffected from one end to the other, and the Turks fear for their line of communication. I need, therefore, deal only summarily with the geographical conditions of the actual ground over which Ottoman armies must advance to strike at Cairo.

The Desert Belt between Palestine and Egypt, though a formidable obstacle, is not prohibitive, and least so in the interval between the late autumn rains (November), and the following June. During this time there is usually abundant, though brackish, water to be found at little depth along the first two-thirds of the course of the coast road, and sufficient, though at greater depths, along inland tracks. After a wet autumn and early winter, such as have occurred this season, the supply is enough for considerable forces.

(*a*) The coast track from Gaza *viâ* el-Arish is not a desert road except for the last third of its course, when it has left the littoral and struck south of the saline marshes to Kantara on the Canal. It is level throughout, and even near el-Arish, where the main track runs awhile along the beach, parallel progress is possible, and water can be got, in sandy palm groves which extend some dozen miles inland. Since the sea does

THE OLD ROAD FROM HEBRON TO EGYPT, THE DARB EL-SHUR, WHERE IT TURNS WEST UNDER JEBEL MUSHRAG, NEAR MUWEILLEH.

BASRA CREEK.

FROM THE EUPHRATES BRIDGE LOOKING NORTH. THE BAGHDAD RAILWAY REVETMENT, BELOW THE CITADEL OF CARCHEMISH, AT LOW WATER.

not admit of any boat not of light draught approaching within some miles of the beach, an army could pass along out of reach of any but the largest modern naval guns. Since, however, the track is soft in its central stretch, and can be cut quickly by landing parties from the sea, it has not commended itself to the Turks. They seem to have used the desert tracks for all their raids up to date.

(*b*) Desert tracks supplied with rare watering-places run from Beersheba, Hebron, and Maan, uniting at Muweilleh or Nakhl, and making for the canal at Kantara, or points south of it. The tracks from Maan, where the Hejaz railway serves the base, have rather too hilly a country to cross in their eastern part for rails to be laid along them quickly or cheaply; but rails could be laid from Beersheba easily enough, and between Kantara and the southern end of the Bitter Lakes access to the canal is open. Near Suez it is more difficult but not impossible. The Desert of Zin, through which all these paths pass, is a rolling limestone country, in great part chalk and flint, naked of any vegetation at all, except desert scrub after rain, and containing hardly any oases, and these mere wady-bottoms. By using Syrian levies, accustomed to traverse desert and steppe country, the Turks have succeeded, however, in advancing over these tracks, but, so far, with small forces only, and few guns. Nor have the troops on arrival within striking distance been, apparently, in good fighting trim. In short, unless a railway can be laid over about two-thirds of the way, it is probable that the immemorial difficulties of desert transit will restrict attacks by these paths to mere skirmishing raids.

Although, as has been truly said, the north Sinaitic desert has never saved Egypt from attack, the front of Egypt itself is harder to force now than it has been before. In the first place, the great moat of the Suez canal defends it from sea to sea; in the second, the Egyptian system of railways gives great advantage to the defence of the one narrow gate by which alone the eastern Delta can be readily penetrated. This is the gate forced by Sir Garnet Wolseley in 1882 at Tell el-Kebir. To the south lies broken sandy desert without any water; to the north marshland, intersected by old canals and arms of the Nile, and soon passing into vast stretches of sea-lagoon, which are all the more impassable for being shallow. An army which had come through the Wilderness of Zin and passed the Canal, would still have very serious difficulties to overcome if the Delta were held against it in force.

(4) Between this area and the fourth, the Shatt el-Arab, stretches the Nefud of North Arabia, and desert conditions are prolonged so far north of this by the Syrian Hamad that no body of troops of any size could be passed from one area to the other, except by way of Aleppo, where, a short time ago, we left the direct line of communication between the fourth area and the capital. Picking up the Baghdad railway at Muslamieh, we proceeded north-east to the Euphrates at Djerabis. The great river has to be crossed on a steel bridge of many spans. I do not know

whether all these are yet in place.* They were to have been so by February last, but certain damage which was done by last year's spring flood, and the disturbance of labour by the outbreak of the war, may have delayed completion. In any case, however, trains can pass slowly over the wooden bridge completed two years ago to further the construction of the other. On the farther side the rails had been laid to Tell Abiad, in the neighbourhood of Harran, and the line was open for traffic by the beginning of last summer; and thence, as far as Ras el-Ain, the earthwork had also been done. I have heard that the rails have since been laid on this last section. If so, half Mesopotamia can now be crossed by the locomotive.

Thus the road-traction as far as Mosul is limited to less than 200 miles over easy, hard desert. From that point the Tigris waterway can be used, by raft as far as Tekrit or Baghdad, and by steamer or large sailing boat thence to a base within much less than a hundred miles of the scenes of operations at Kurna, at Ahwaz, and near Basra. Long, broken, and toilsome as this route of communication is, the Turks have brought up a good deal of heavy artillery by it, and, by one way or another, have managed to collect and supply an army of more than 50,000 regular troops, swelled by a considerable but varying auxiliary force of Kurd and Arab irregulars.

There are some special geographical difficulties governing our operations in this area. We are confined to the immediate neighbourhood of the great waterways of the Shatt el-Arab and the Karun, in a deltaic region. Their shallow valleys are flooded at this time of year by the melting of mountain snows, while at short distances on either hand, desert or marsh conditions prevail. Both the deserts and the marshes are ranged or inhabited by powerful tribes. Our communications, therefore, have to be our main solicitude, and while the floods last, they must be very difficult to safeguard. The tribes on the left bank of the Shatt and up the lower course of the Karun are, like all marsh Arabs, of ill repute. The great and warlike Muntefik tribe on the right bank demands very decisive success on our part all along the line before throwing in its lot with our occupation.

Add to these difficulties a soft mud bar at the mouth of the Shatt, which does not admit, without great difficulty, warships of greater draught than light gunboats; the fact that steamers cannot ascend the Karun above the rock bar of Ahwaz; the pestilential climate of a deltaic region, situated in the hottest part of the globe; the winding, sand-embanked character of the lower Tigris; the choked state of the lower Euphrates; and the marshy nature of the land which extends between their channels for a considerable distance above their confluence. The conditions are certainly not favourable to active

* Since the above was in type, the bridge has been reported complete.

operations beyond the points already attained by our forces, so long as a decisive blow has not been struck at the heart of the Ottoman empire and the defending forces are adequately supplied. Least of all should an advance on Baghdad, which lies nearly 600 miles by river from the Persian Gulf, be expected.

Such is a summary statement of the geographical conditions under which Turkey is now waging war. When one remembers that she is barred from all her own waters, except those between the Dardanelles and the Bosphorus, and has to maintain all communications by thousand-mile land routes, very imperfectly served by either railways or military roads, one cannot but wonder both at her hardihood in undertaking war and the degree of efficiency with which she has prosecuted it so far. Her economic condition is one of sheer bankruptcy; she cannot repair in her arsenals and navy-yards a tenth of her waste, and something like half her not large population cannot or must not, for one reason or another, be used to fight her battles. *E pur si muove!* It has often been said that the thing in which a Turk is least behind the standard of his time is the art of making war, and the one condition in which he feels at home is a state of war. He is giving the world rather a striking illustration of the truth of both assertions at the present moment.

The PRESIDENT (before the paper): I am not going through the form of introducing Mr. Hogarth to this audience. We all know him and remember the admirable lecture he gave us on the Balkan Peninsula and the distribution of its peoples only a year ago. We know Mr. Hogarth as an archæologist, an explorer, and an author. He has described himself in the title of one of his books as 'A Wandering Scholar,' in another as 'An Antiquarian' who has met with accidents. I hope we may hear of some of these accidents in his paper to-night, but his main purpose will be to describe the geographical conditions which are likely to affect the war which is now raging and the peace that may follow it. I will ask Mr. Hogarth to read his paper.

Sir EDWIN PEARS (after the paper): It is probable that I am the last man in the present audience who was in Constantinople; I left it on December 9. In reference to what we have heard from Mr. Hogarth in his very valuable and delightfully delivered lecture about the behaviour of the Turks towards British subjects and the treatment of their property, my experience entirely agrees with his. Two days ago I received a letter by "underground post" from Constantinople in which my correspondent said: "As to your house at Prinkipo," in which my library is, and which contains a number of objects that are valuable to me, "I am happy to inform you that not a thing has been touched; it has been carefully respected by the Turks." My only fear is lest the Germans should disturb it. There has been no complaint whatever of the conduct of the Turks to any British subject in Constantinople itself. That they have behaved well is the simple truth which I gather from letters and from at least a hundred refugees known to me in London or its neighbourhood. Amongst other capacities the Turk has a long memory for benefits received. He remembers we fought for Turkey during the Crimean war, though he cannot understand how it is we have allied ourselves with the Russians. The same testimony comes also from Smyrna. We, who are British subjects and who have resided in Turkey, have no fear for the conduct of the Turks. I have,

therefore, pleasure in testifying to the correctness of what Mr. Hogarth has said on this point.

I want to express the satisfaction with which I have listened to Mr. Hogarth's admirable lecture. I do not agree on two or three minor points which do not affect the body of his argument. For example, he made the statement that I have seen over and over again in the London newspapers, that the current is always running from north-east to south-west both in the Bosphorus and the Dardanelles. This is incorrect. I myself could give you many instances from my own experience in illustration. On one occasion I had to go from Constantinople to a village halfway up the Bosphorus. I found that a south wind was blowing, and as soon as we got into mid-stream, the caiqueji made himself comfortable, and our boat flew up the Bosphorus at the rate of 4 or 5 miles an hour—directly in the opposite direction from that which we have been told by newspapers that the current always flows. The same thing happens, though at not so great a speed, in the Dardanelles itself. I know every mile of the Dardanelles from personal experience. It has been my lot as a lawyer for forty years out there to have to deal with certainly not less than from seventy to one hundred collisions or strandings in the Dardanelles or immediate neighbourhood, so that you would have some difficulty in puzzling me as to the depth of water and topography of the hills in these straits or in the Bosphorus. But I repeat this is only a slight mistake that does not affect the substance of the paper. When Mr. Hogarth spoke of the bad roads leading along the central tableland (always bear in mind that the centre of Asia Minor is a tableland rising from 2500 feet on the west up to 6200 at Erzerum), and when he recalled the difficulties of the roads beyond the last station on the railway at Angora, and spoke about their being practically impassable, I can only add that I found it so last June. I had gone up in that month to deliver the Commencement Address of the Marsovan College. When I had accomplished that part of my task, I proposed to make the return journey from Marsovan to Angora, but I was told that I could not possibly reach Angora under a fortnight—a distance not more than 120 miles. There is just one other remark. I know something of the history of Turkey, and I can hardly admit that the Turks from the first fixed on the north-west corner of Asia Minor. I remember that you have the Seljukian Turks in the tenth century; that in the eleventh century they were in full force when the First Crusade commenced; that the first obstacle which they encountered was at Nicæa, the "City of the Creed," which was then (in 1096) in the possession of the Seljuks; and that these Turks had been a powerful nation around Konia for a century earlier at least. The idea of the Ottoman Turks two centuries later was to absorb the smaller groups who were in the country. They accomplished this task, and then they gradually extended themselves to the north drawn by the magnet of the fame of ancient Rome. I can only say that like everybody here, we all hope that the Dardanelles is soon going to be forced. It is a very tough job, but we all believe it is going to be done. I think I may say, in conclusion, that I do not consider the Turk regards his possible departure from Constantinople in quite the same light as has been represented by our lecturer. They discussed four weeks ago the question where the archives should be carried to in case the Dardanelles were forced. The three places suggested were Brusa, Eskischeir, and Adrianople, Eskischeir being at the head of the ascent to the tableland and upwards of 2000 feet above the sea-level. Enver Pasha, who may be regarded as the strong man in the military party, the one who conspired with the Germans to rush Turkey into the war, was favourable to going to Adrianople, but he met with a unanimous refusal on the part of the other ministers, because the belief of every Turk is that as they came from Asia to Asia they will return. I myself think it is quite possible that the place from whence they came may really

be said to be the plains around Konia. The history of Turkey suggests a reversal of the process of their conquest. The year 1683 may be taken as the zenith of Turkish conquest. Up to that time the Turkish Empire had been steadily growing. Remember what a big empire it was. The Turks had not merely been occupied with the north-west corner of Asia Minor. They had Egypt; every other country on the north shore of Africa; the whole of the south of Russia; nearly the whole of what is now Austria. If you were to make a series of maps beginning with one in 1683, and let each one be thirty years later, you would find a steady diminution of territory down to the present time, and I think many in this room will live to see Turkey left out of Europe altogether. In that case I do not think Turkey will be very much disappointed. She will take it easily, and I do not believe there are many, even of the Young Turkey Party, who have ideal aspirations which centre about Constantinople itself. We have all enjoyed a charming lecture, and, if it were not out of place, it would be pleasant to dwell upon its lucidity, comprehensiveness, and firm grasp of the subject.

Sir Henry Babington Smith: Mr. Hogarth's interesting paper offered many points of absorbing interest, but the impression that is most strongly left upon my mind is the extraordinary difficulty of carrying on a war in four theatres, three of them divided from the centre by an enormous distance, without command of the sea. Mr. Hogarth pointed out the huge difficulties attending the supply, from Constantinople, of an army near the Suez Canal. On the other hand, the power which has the command of the sea chooses Egypt as a convenient base for the attack upon the Dardanelles—precisely the same distance in the reverse direction.

Whatever may be the decision in the three remote theatres of war, there can be no doubt that the capital operation is that in the central theatre which touches Constantinople. That is the district with which I have most personal familiarity. Mr. Hogarth did not touch on the question of the cartography of Turkey, to which he has himself contributed a good deal. But there is one interesting point as regards the cartography of the country immediately around Constantinople. There is a good map of that particular bit of country, produced from his own personal surveys by General von der Goltz in the late eighties and early nineties, when he was attached to the Turkish army. In his preface von der Goltz describes the difficulties under which he had carried out his surveys. He says he had to do it on Fridays and Sundays, and under some opposition from the Turkish authorities themselves; but he was continually driven forward "by the thought of what the world would say if some day or other there should be fighting in the neighbourhood of Constantinople, and if the want should then be felt of a thoroughly good map for the use of the garrison of Constantinople, while at the same time it could be said that an officer of the Prussian General Staff had been attached to that garrison for a period of ten years." Von der Goltz is now in command of the first Turkish army, and his map will no doubt be of use to the garrison—and to their assailants—if there should be fighting in the immediate neighbourhood of Constantinople.

Whether there will be fighting there depends upon many things, and I imagine on one factor in particular—whether a landing is effected from the north on the coasts near the Bosphorus. Mr. Hogarth treated that operation as a very difficult one, and indeed rather out of the question, partly because it had never been attempted before. But the conditions are not the same as in previous times, and if it be the case that the Russians have now command of the Black Sea, it would not be very surprising to find that operation attempted. Mr. Hogarth regarded the lie of the country as offering very great obstacles to a landing. I rather doubt if that is the case. The coast consists of low cliffs with a sandy beach, hard and good

going. It very much resembles in its general features the coast of Norfolk in the neighbourhood of Cromer and Sheringham: there are cliffs varying in height, with a sandy beach, harder than the Norfolk beach, below them. I remember riding along it some years ago almost exactly at this time of year, in a strong bitter north wind, with showers of hail and sleet all the time. It was not very inviting then, but from the point of view of landing I doubt if it offers very serious difficulties. It is true that the watershed of the country between that and the Marmora lies very close to the Black Sea, and therefore the ascent is somewhat more rapid on that side. But the height is not great; the hills rise in some parts to as much as 800 feet, but, generally speaking, not above 500, and in many places the slopes are not steep. It is rough, scrubby country, but a force that had once effected its landing and made good its position would not be met with very serious obstacles in the way of hills to surmount. As regards the Bosphorus, it is perhaps the case that the military preparations for resisting penetration there are not so formidable as in the Dardanelles; but the fortifications are strong all the same, and although they are confined to the northern third or possibly half of the Bosphorus, still they would present a formidable obstacle to a purely naval attack.

On the wider questions dealt with it is too late now for me to speak, even if I were competent to do so; but I would venture not entirely to agree with Mr. Hogarth as regards the motive which has led the Turks to throw in their lot with Germany and Austria rather than with the Triple Entente. The desire to be recognized as part of the European comity of nations may be one motive which weighs with them to some extent; but I think there were more solid motives of what they consider to be the interest of the Turkish Empire which weighed with them in taking that decision, so far as it was a voluntary decision.

The PRESIDENT: At this relatively late hour I must not invite any more of our Fellows to take part in this discussion, and I shall confine myself to one or two points only before asking Mr. Hogarth to reply to the questions that have been raised.

In the first place, we speak of the way in which Turkey has turned. Mr. Hogarth reminded us of the fact that the Turks have, at no time, succeeded in governing themselves; they have rather gone to others, like the Italian cities which took a governor from outside. They have found their governors among alien races, in Greeks, Armenians, and latterly Jews. May it not be the fact that the average Turk throughout Turkey still retains that affection for England and that disposition to receive an Englishman with greater hospitality than any other foreigner which he certainly had fifty years ago, and I believe has had up to the last few years? It appears to me, that in discussing the conduct of Turkey at the present moment, we should separate the Turkish nation and the governing classes. With regard to the four scenes of operations, the only region I know, and that mainly from a bird's-eye view, is the Armenian region. That country, though always a difficult country, is one the difficulty of which is enormously increased by winter. In the summer and autumn months, when the snow is melted off the hills, I do not think that Armenia would prove an exceptionally difficult country to campaign in. The ridges are high, but the plains between them are also 5000 to 6000 feet above sea-level, and the passes dividing these plains involve ascents of 2000 or 3000 feet, or often less. I have overlooked this region from the slopes of Ararat. One sees thence mountains lying about in great isolated blocks, with plains lying between them. I should imagine that, if the Russians can put sufficient forces in the field, they may win a considerable amount of territory there before next autumn.

Perhaps the most important, in some respects, of all the regions dealt with

to-night, was Mesopotamia. It raises the most difficult problems. The division of Persia, which was made a few years ago, was made with a very natural caution on our part, but it has left, as caution often does, a situation full of difficulties. Russia took half Persia under her protection; we, afraid probably of adding to the burdens of India, took a little corner, and left two-thirds of the other half to remain a sort of debateable or No-man's Land. What will be done with this region when peace comes is likely to be a difficult question. It cannot permanently remain a No-man's Land (we get a considerable amount of oil for our Navy from it), while there are, no doubt, great objections to throwing upon India the extra burden of a province at the head of the Persian Gulf. I have heard a suggestion that we should reconstitute two ancient Turkish Governments. We might have a Sultan of Baghdad, reigning under our protection, and a Sultan in Asia Minor. Lastly, what we have heard of the Baghdad railroad shows how far-reaching German policy was; how through the alliance with Turkey Germany hoped to stretch a great belt, to place a barrier right across the two continents, and thus separate the Western Powers from India, and hold Russia back from the Mediterranean. I will not keep the Meeting any longer, but will ask Mr. Hogarth to reply to any questions that he wishes to answer. At the same time, I must thank him on your behalf for the very great deal of information he has given us in his extremely lucid and compendious lecture.

Mr. HOGARTH: I must thank you for the patience with which you have listened to a rather rapid discourse ranging over several widely separated areas. The summary nature of the treatment imposed upon me by the subject must be my excuse for the unqualified statement about the currents in the Bosphorus and Dardanelles, to which Sir E. Pears has taken exception. I was not unaware either of the existence of eddies setting back against the main streams on both banks, or of the temporary effect of occasional south winds. But if one is to make a short general statement about the currents, it must be, I submit, the one I have made. I did not say—or did not mean to say—that the Angora-Erzerum road was "impassable," but only that it was very long and toilsome. With regard to Sir H. B. Smith's objection to my views about the difficulties of attacking Constantinople from the coast north of the Bosphorus, I admit that the actual shore presents no great impediment; but if he admits, for his part, that the watershed rises steeply at a short distance behind it to heights of 500 to 800 feet, he seems to me to support my main contention; for, if this war has taught us anything, it has taught us that quite small hills, if stoutly defended, are still terrible obstacles. How long have the moderate heights of the Carpathians and the Vosges been in dispute? The more general questions about the origin of the Ottoman State and the present aims of those in power in Turkey, I will not try to argue further at this hour. I do not read the history of the relations of the Seljuks and the Osmanlis quite as Sir E. Pears does; nor do I think that, whatever be the readiness of the "man in the street" at Constantinople to retire to Asia, his view is shared by Enver Pasha. But these are matters rather of opinion, and I recognize to the full the right of such authorities as Sir E. Pears and Sir H. B. Smith to differ from the views I hold.*

* The following maps may be referred to:—

Turkey in Asia as a whole.—R.G.S. Map of East Turkey in Asia, scale 1 : 2,000,000, 1912, and R. Kiepert, *Karte von Kleinasien*, scale 1 : 400,000, 1901–1914. *Dardanelles and Bosphorus.*—Admiralty Charts Nos. 2429 and 1198. War Office Map of Turkey, scale 1 : 250,000, Constantinople and Gallipoli sheets. *Armenian War Area.*—Lynch and Oswald's Map, scale 1 : 1,000,000 (Stanford), 1901, revised 1915. *Persian Gulf.*—Survey of India, Southern Asia Series, scale 1 : 2,000,000, Southern Persia sheet.

GEOGRAPHY OF BRITISH FISHERIES.*

By Professor J. STANLEY GARDINER, F.R.S.†

FISHING, next to agriculture, is the greatest of British industries, judged by the number of men engaged, the amount of capital invested, and the importance of the product to the food of the people. It is an industry which has its risks, but it breeds a race of healthy men. The forces of nature teach self-reliance, and it is this quality which causes fishermen to be the least fostered class of the nation, yet perhaps the most valuable. The fishing community is little recruited from outside, and it can never be adequately replaced. It is prolific, and three-quarters of its excess population enter the navy and merchant service. Its men possess an hereditary instinct for the sea, and the war is surely demonstrating the fact that the value of such men is as great even in this age of mechanics as in the times of Drake and Nelson.

The wholesale value of fish landed in our ports is about 15 million pounds for about 25 million cwts. To this must be added upwards of 2½ million cwts. imports of fresh fish and about 1,400,000 cwts. of canned and cured fish, largely canned sardines, salmon, and lobsters. Further, many foreign fishing boats habitually discharge their cargoes in our ports, particularly at Aberdeen. About 1½ million cwts. of fresh fish are exported, together with 9½ million cwts. of cured or salted herring, cod, mackerel, pilchards, and haddocks. The number of first-class steam fishing boats is upwards of 3000, and of all first and second class fishing boats about 10,000; to these must be added a vast number of small longshore craft and boats employed in the various shellfish industries. The total number of whole-time fishermen is upwards of 125,000, while there are as many half-timers. Taking the whole industry, fishermen, curers, distributing agents, etc., it may be estimated that it gives support to one-twentieth of the population, while the capital sum directly invested must be about 200 million pounds.

The industry is pursued in both fresh and salt waters. Salmon and eels are caught in fresh waters, but they are of little value in the food of the people; they are interesting on account of their long migrations, the salmon being a fresh-water fish which fattens in the sea, and the eel a salt-water fish which fattens in fresh water. Rather landsmen than fishermen, to some degree redeemed by their summer yachting, are the purveyors of oysters, cockles, mussels, and periwinkles, luxuries suitable to all classes since the days of Rome. Of these oysters are cultivated to only a slight degree compared with the almost illimitable possibilities of our numerous creeks and estuaries, but the rest are merely collected

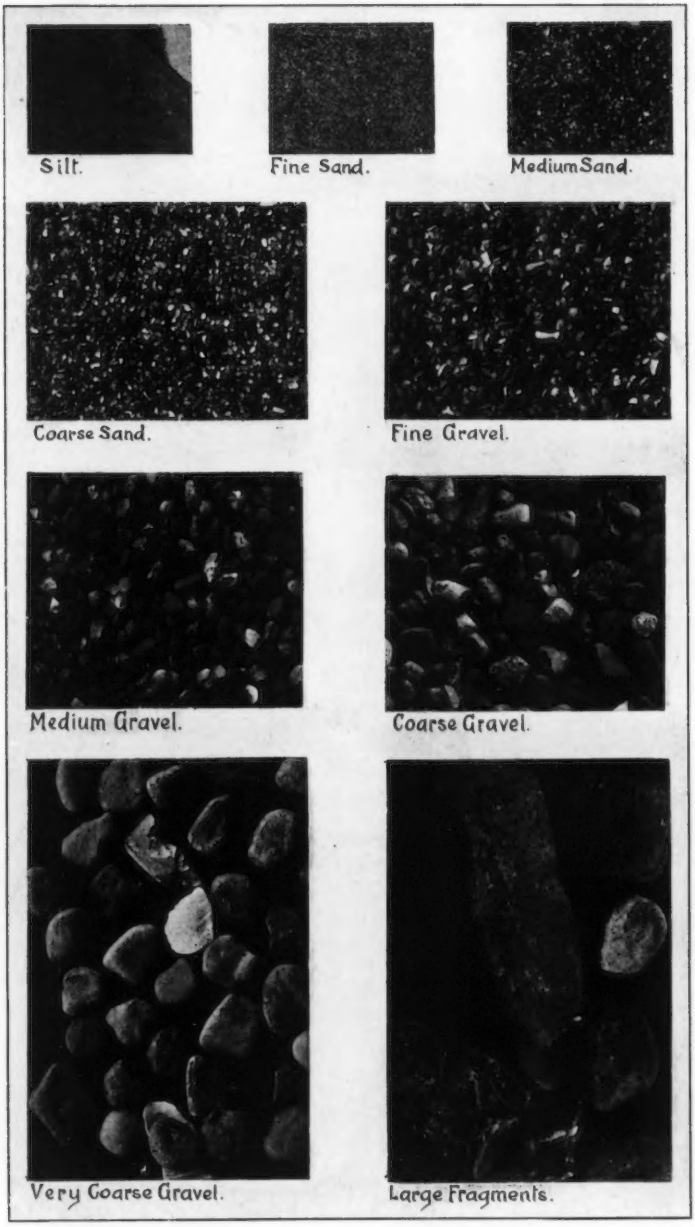
* Royal Geographical Society, March 8, 1915. Map, p. 552.

† I have to thank the Board of Agriculture and Fisheries for the photos of the bottom deposits of the North Sea; Prof. W. A. Herdman for those of the floating life of the sea; and Mr. I. S. Doeg for those of Aberdeen.

HERRING BOATS, ABERDEEN.

ABERDEEN FISH MARKET.

ABERDEEN FISH WHARF.



FEATURES OF THE BOTTOM DEPOSITS OF THE NORTH SEA, × 2/3.

where they have happened to grow. Lobstermen and crabbers daily put down their pots, at times shooting their seines or drift nets, when shoals of herring, mackerel, or pilchards appear in their bays. Then come the "longshoremen," true fishermen, sailing small craft, using trawls, seines, and drift nets, never going far from our coasts, seldom out of sight of land, but at times undertaking voyages of 100 miles or more in the search for particular fish, for which there are local dealers. These men, the small-holders of the fishing community, owners of their own boats and gear, are of great social importance, but the food value of the fish caught by them and all these classes is so inconsiderable that they must be neglected here.

The deep-sea industry as it now exists alone concerns us; its evolution not at all. It requires good harbourage, abundant docks, and large markets, with excellent communications. It is a considerable factor, in most the chief, in such ports as Aberdeen, Grimsby, Hull, Yarmouth, Lowestoft, Milford, Fleetwood, and North Shields, the first five and Billingsgate each with landings of over a million hundredweights a year. The reasons for the development of these ports and for the great concentrations therein implied are purely geographical, proximity or convenient access to particular fishing grounds and to markets, application of steam, and the opening up of new fishing grounds.

TABLE OF FISHING GROUNDS.*

No.	Regions.	Area in square miles.	Scotch and English demersal fish in cwts., 1913.	All countries. All fish in cwts., 1910.	Principal demersal fish by weight.
I.	White Sea ...	128,917	148,589	762,198	Plaice, cod, haddock.
II.	Coast of Norway	29,648	6,119	8,289,888	Cod, coalfish, haddock.
IV.	North Sea ...	129,804	5,413,222	21,942,160	Haddock, cod, plaice.
V.	North of Scotland	18,096	1,119,643	2,483,208	Cod, coalfish, haddock.
VI.	West of Scotland	32,099			
VII.	Iceland	36,608	3,169,153	4,185,218	Cod, haddock, halibut.
VIII.	Faroes	4,949		690,461	Cod, haddock, coalfish
IX.	Rockall	3,430	56,496	94,846	Cod, skate, halibut.
X.	West of Ireland	9,066	148,883	88,672	Hake, haddock, ling.
XI.	South of Ireland	50,416	623,194	1,354,518	Hake, skate, megrim.
XII.	Irish Sea ...	15,743	225,934		
XIII.	Bristol Channel	8,613	113,757	1,220,740	Skate, plaice, whiting.
XIV.	English Channel	25,238	193,242		
XV.	West of France	25,422	14,505	45,043	Hake, skate, sole.
XVI.	North of Spain ...	5,464			
XVII.	Coast of Portugal	9,997	55,340	79,538	Hake, skate, sole.
XVIII.	Coast of Morocco	10,499			
	Mixed grounds ...		273,046	274,093	

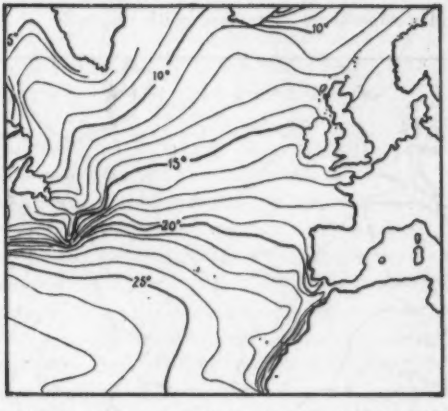
* This table is founded on the English, Scotch, and International returns. France and Portugal are not included. French returns show about 2½ million cwts. from the same regions, and the Portuguese fishery is worth about £1,300,000 annually, half being for sardines; tunny and anchovies appear in these returns. There are no Spanish returns. The numbers I., II., etc., refer to the map on p. 552.

Fishing a century ago was almost a coastal industry, while now it is pursued from the White Sea (Barents Sea) and Iceland to beyond Mogador, through over 3500 miles and 45 degrees of latitude. It covers all grounds of the continental shelf of Western Europe and Iceland even down to 300 fathoms; toll is also taken from all neighbouring banks which rise to within the 100-fathom line, the South Faröe, Rockall, and Porcupine. The grounds, as divided for statistical purposes, and their extent, together with our catch of bottom-living (demersal) fish from each, and the total catch of all countries, including all fish, are given in the preceding table. Off Spain, Portugal, and Morocco they form narrow fringes to the land, and the existence of our fisheries there *depends on* 3 miles being retained as the limit of territorial waters. The Baltic Sea is not fished by us, and the Norwegian coasts but little, while from the rest of the ground our trawlers take the chief toll of demersal fish.

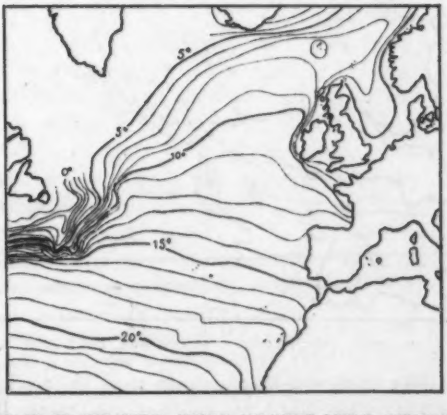
This is as much as need be said here as to the topography, which is excellently shown in the Admiralty charts. What more especially concerns us are the habits of the fishes, their growth and reproduction, in so far as they are affected by the physical conditions of the waters in which they live. As to man correlation with environment is now possible, since we know his physiology, his habits, and his food. Of fish we know little—some of their movements and what is actually found in the stomachs of caught specimens; in addition, most food fishes pass through in development a whole series of forms, each of which as much requires its special environment and food as the tadpole of a frog. It is, however, this correlation of habits with physical conditions that is essentially the geography of living animals; not that topographical distribution (too often termed "geographical distribution") which depends on the geological periods in the evolutions of different species and on our knowledge of subsequent changes in topography. Not only have the adult fish to be considered, but also their eggs, their larval stages, and the eggs, young and adults of all the lower animals and plants on which they feed —a truly herculean task.

It is obvious that there must be great diversity in the hydrography of such widespread fishing-grounds, some of which are oceanic and others partly enclosed seas. All are affected by the Gulf Stream, the perpetual contention of which with the East Greenland current and with Arctic ice needs no description. It induces currents in the partly enclosed waters round our coasts, of which those in the North Sea swirl down its west side, cross by the south, and thence pass in front of Holland to the Skagerrack. These currents merit particular attention, for the eggs and (or) young of practically all our food fishes are passively distributed by their agencies. Fish spawn at regular seasons and generally in the same neighbourhoods year after year, and it is necessary that their young should be widely and evenly spread over grounds suitable for their further growth. Those which fail to reach, or are carried beyond, such

grounds perish, while insufficient dispersal must mean the destruction of vast numbers by starvation. Currents fluctuate considerably from year to year, and undoubtedly the success or failure of any year's brood largely depends on these fluctuations, though this is probably less the case in the relatively homogeneous North Sea than in any other region.



SURFACE TEMPERATURE, NORTH ATLANTIC OCEAN, AUGUST.

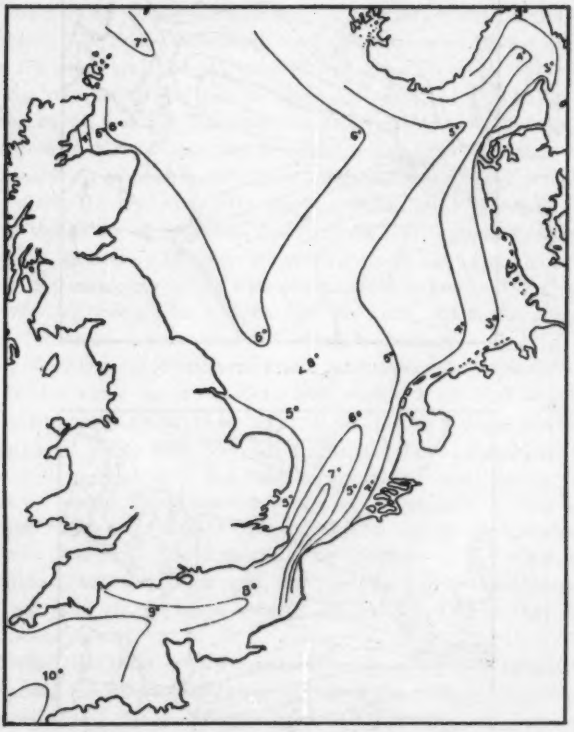


SURFACE TEMPERATURE, NORTH ATLANTIC OCEAN, FEBRUARY.

Fortunately each topographically separated area has its own spawning grounds, and unfavourable conditions in one generally mean favourable conditions in another. Thus statistics may show no alterations of total catch in the year when the young should reach maturity, though fish from other areas have not by migration filled up the vacant grounds.

Adult fish are not carried by currents, and, indeed, when resting or feeding, tend to move against their direction of flow, such movements producing better respiration and meeting the stream of food.

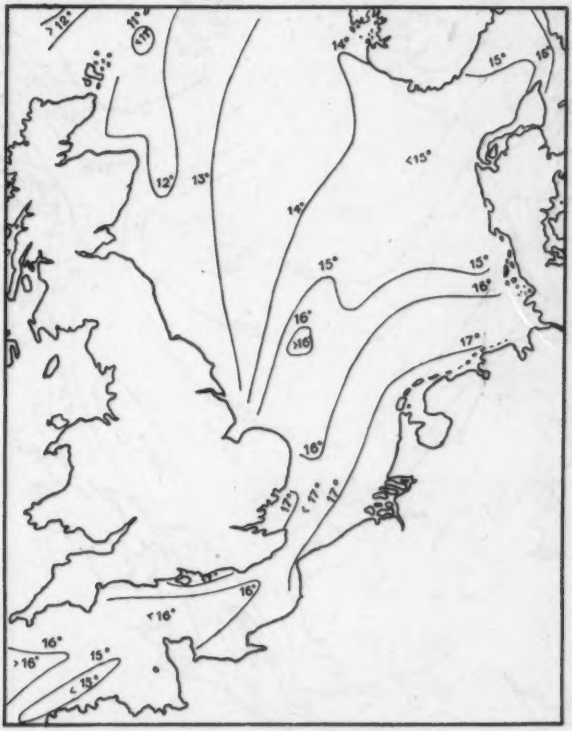
Currents mean changes in the temperature and salinity of the sea-water, and their real movements are best ascertained practically by the thermometer and chemical analysis. In deep seas salinity as a rule increases and temperature decreases with increase of depth, but in



SURFACE TEMPERATURE, NORTH SEA, FEBRUARY.

our comparatively shallow fishing-grounds there is much mixing. In the Irish Sea and in the North Sea south of the Dogger Bank, each fed from two directions, it is so thorough that a constant salinity is found from the surface to the bottom, the saline Atlantic and the brackish coastal waters completely blending. Elsewhere, as in the Channel and the northern part of the North Sea, the Atlantic flow can be followed at some seasons by temperature and salinity observations, while at others large isolated masses of Atlantic water may remain distinct for many months; in the Channel the main flow inwards is of French coastal

water reinforced at times from the Bristol Channel. Actually the isotherm of 10° C. in September extends from Newfoundland to Iceland and the Barents Sea, while in March it commonly passes to the south-west of the British Isles and thence to New York with a northern extension between. Surface isohalines show tailing off from 37 °/∞ * off the Canary Islands to 33 °/∞ in the Barents Sea, and these also vary

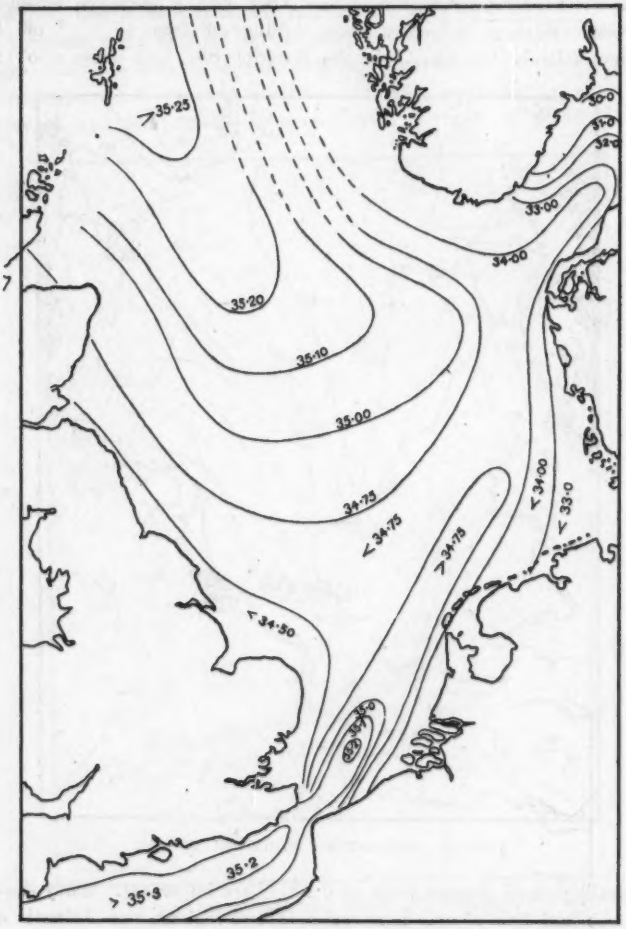


SURFACE TEMPERATURE, NORTH SEA, AUGUST.

seasonally; small changes even of 0·1 °/∞ are important. They show a real ebb and flow of the boundaries of two regions, the Atlantic and Arctic, characterized respectively by warm saline and cold brackish waters. A further subdivision of the Atlantic is into ocean and coastal regions, the former characterized by its relative uniformity and the latter by its great seasonal changes, high summer and low winter temperatures, and its lessened and varying salinities due to greater rainfall and land drainage.

* Viz. 37 parts per thousand, or 3·7 per cent.

The West European fishing ground is further complicated in that the channel is the boundary between two provinces of littoral distribution, the boreal and Mediterranean. Their line of separation about follows the

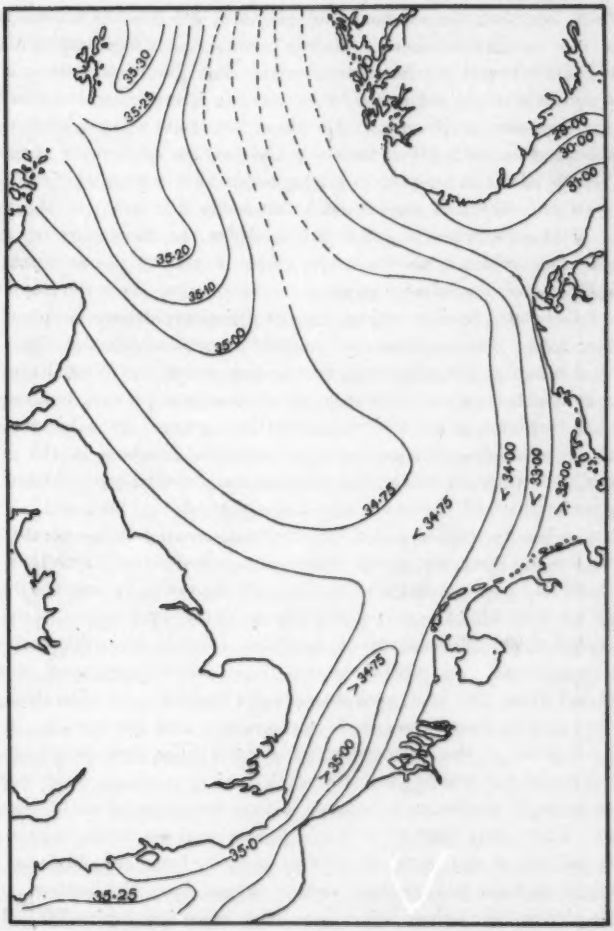


SURFACE SALINITY, NORTH SEA, FEBRUARY, 1903-07.

(*After Thompson.*)

ridge connecting Scotland with Iceland, roughly the mean isotherm 10° C. Judging by their animals and plants, they must have been separated by land at no distant date. The Scotland-Iceland ridge now only forms a barrier for the deep-sea animals of the temperate Atlantic and northern Atlantic, which may appropriately be termed the Norwegian Sea. The

upper waters of the latter have been completely changed by the periodic inflow of the Gulf Stream, which has introduced a vast number of "Mediterranean" littoral forms, so that in its southern parts, particularly



SURFACE SALINITY, NORTH SEA, AUGUST, 1903–07.

(*After Thompson.*)

the North Sea, they form the bulk of the population. The real distinction between the two provinces can, of course, only be seen by comparison of detailed lists of their animals and plants, but the fishes roughly follow the division. Thus of demersal species the hake, sole, bream, gurnard,

and skate are clearly southern, while the cod, haddock, plaice, and lemon sole are northern. Of less coastal species, brill and turbot are southern, while certainly halibut and probably ling are northern, though the latter has spread as far south as Morocco. Of pelagic fishes the herring and sprat are northern, the anchovy and pilchard, which is the mature stage of the *true* sardine, southern. Mainly oceanic and a true southern type is the mackerel, and in the same category, but purely oceanic, are the tunny and bonito, not yet fished by us, but the former caught extensively by our southern neighbours. All these are relatively shallow-water forms, while the real home of the eel is the deep sea beyond the Azores.

There is no doubt that our fishing grounds have a peculiar richness of their own, the enormous annual catch not being due solely to the great extent of shallow water. Adult fish feed for the most part on small living animals, which in their younger stages of growth are as dependent as fish themselves on suitable physical conditions for their development. They in their turn feed on others, but all ultimately depend on plant life for their food. The considerable quantity of organic remains from the land undoubtedly adds materially to the richness of the West European shelf, but attached seaweeds are of small moment, not growing extensively below 25 fathoms. In the ocean floating plants are all-important, minute unicellular organisms living in incredible numbers in the upper layers of the water, in suitable conditions daily multiplying themselves, giving a fertility to the sea many times that of the best soil. Their quantity is less in tropical and Arctic regions, greatest in temperate, and it is to the environment of our fishing areas favouring them that the abundance and good condition of our fish are largely to be ascribed.

The cycle of life of such pelagic plants in the open ocean is simple, complicated only by fluctuations in sunshine, rainfall, and other meteorological conditions. In coastal waters, especially where broad shelves extend out from the land, such fluctuations are more considerable, and often enormous seasonal changes in temperature and salinity have to be added. Instead of the same species of plants all the year round, and in consequence of the smaller animals which feed upon them, there may be a whole series of species, each suitable to some particular phase of seasonal change. There may thus be a much greater variety in the number of species, but not at any moment. Form succeeds form, the old forms disappearing, perhaps passing into resting stages upon the bottom, until suitable physical conditions bring them once more into active life. It is a matter of doubt, but it seems possible that this very destruction and recreation adds still further to the total food of our seas. It, however, has its dangers. The small larvæ of our food fishes depend almost exclusively on these minute plants, and unless the physical conditions, when they hatch, are also suitable for their particular plant foods, they may all perish. Fortunately, it is generally a question whether the temperature is high enough or not, and the lower the temperature the

longer time the eggs take to hatch, so that unsuitable fluctuations of minor moment tend to be obliterated. Ultimately it is a matter of the hydrographical conditions, but the study of the changes in all pelagic life is essential for the understanding of the means by which these act for good and evil, and also gives information supplemental to that obtained by physical means.

No mention has been made of the bacteria of the sea, of which there have been estimated to be about 600 millions in a cubic yard of sea-water. The bulk are concerned in the destruction of organic matter and the setting free of its simple salts; remembering the mode of plant nutrition, they are hence not destructive to the total food. Nitrogen is required by plants in the form of nitrates and ammonium salts. In the sea, as on land, there are bacteria which form and destroy these, the latter dominant in tropical waters. Some of the nitrogen compounds come from the land, which adds largely to the available phosphorus equally necessary. Soluble silicic acid is also essential to many unicellular plants (diatoms), and this too is a land product. Finally, the slightly greater alkalinity of coastal waters would seem to be favourable to abundant life. Indeed, I fancy that the primary cause of the peculiar richness of our seas will be found to be the especially abundant and rich supply of the above products by drainage from the land.

The nature of the bottom necessarily concerns demersal fish, and also such pelagic fish as lay their eggs upon the bottom. The latter require a hard bottom with some current, so that the eggs get well aerated and are not silted over. To the former it is mainly a question of the suitability of the ground to the animals upon which they feed. Sedentary animals generally require stone. The lug worm is almost the only animal in mud, but there are a whole series of worms belonging to sands of different grades. The same is true of molluscs, starfishes, some crustaceans, and other forms. The southern part of the North sea has been charted by Mr. J. O. Borley into areas of different textures of bottom, ranging from stone through various grades of gravel and sand to mud. Each texture is shown to be the centre of a biological association of animals. Statistics of catch indicate the preferences of each fish, but the area charted is too restricted to allow of bold correlations. Mud or silt is the least prolific texture; where it deposits, there must be complete stillness, little circulation of gases in the water, the decaying organic matter forming a thin soup over the bottom in which plaice would appear to be almost smothered. The quantity of organic matter in the bottom layer is everywhere considerable, but there must be movement for its constituents to be leached out as required. The cod family possesses in the cod, haddock, hake, ling, coalfish, and whiting a few species of such remarkable adaptability to different grounds that they are of vast economic importance. The cod and the haddock, the two most important species, prefer respectively rocky and sandy grounds. In

contrast to these there are a large number of fish of many families which hide away, isolated, in rock and weed, none of great value. Then there are the inhabitants of the sandy ground, on which they rest invisible to their enemies. They include the halibut, turbot, brill, plaice, lemon sole, witch, dab, flounder, and true sole, all belonging to one family of more or less laterally flattened species, and the skate a dorsi-ventrally flattened shark. They are the most prized of our fish on account of the firmness and fatness of their flesh.

It would scarcely be expected that tides would produce much effect, direct or indirect, on fisheries. They probably aid in mixing coastal and oceanic waters, and their currents sweep clean the bottom of the Scotland-Iceland ridge. As an example of the strange directions into which fishery research leads its devotees, it is interesting to note that Pettersson has shown that the average maximal value of the tide-generating forces undergo variations in periods of $4\frac{1}{2}$, 9 (?18), 88, and about 1800 years. He suggests that these periodical changes may be reflected in changed climatic conditions and in changed hydrographical phenomena, stronger currents, higher temperatures, and so on. Animals being peculiarly sensitive to the medium in which they live, the effect on fisheries might be very great. Thus, at the above maximal periods, the greatly increased eruption of salt water into the very brackish Baltic might well revive its rich mediæval herring fisheries. Probably tidal also are certain vertical movements of 50 fathoms or so in the intermediate waters of the Færoe-Shetland channel, submarine waves.

A few examples from our food-fishes will perhaps best illustrate the all-important connection there is between the life-histories of marine animals and the physics of the sea. The plaice and cod are chosen to represent two families of demersal fish, the herring coastal pelagic forms, the mackerel as belonging to the temperate Atlantic, and the eel, a peculiar deep-sea breeder, its life-history now practically determined after a quarter of a century of keen struggle by dozens of workers. In no sense do the life-histories of these fish represent those of other fish, even of the same families. Each fish has its own spawning ground, its optimal depth, salinity, and temperature, its own wanderings, and its own peculiar development.

The plaice is the most important trawled fish of the southern part of the North Sea, a drainage basin for some of the densest areas of population in the world. It is a much-fished area, and for many years fishermen have said that it has been falling off as a plaice ground, this being ascribed to overfishing and the destruction of undersized fish, both being causes which might be remedied by international legislation. It is this suggestion that has put the plaice in the forefront of international investigations, with which the names of Masterman and Heincke are most honourably connected. The result of their work has been the estimate that there are 1500 million plaice of over 12 cms. in the North

Sea; of these a third are caught annually, 200 millions being put on the market, and 300 millions being destroyed in the process of catching.*

The plaice is a bottom feeder and lives on molluscs, worms, some crustaceans, and starfishes, being a dweller on sandy ground, where these are most abundant. It collects in definite spawning areas, the chief of which is off our coast between Dover and Cromer, others of little importance being off Flamborough Head and in the Moray Firth. Spawning is at its maximum in February, the spawners being four years old and upwards; the eggs and subsequent larvæ are pelagic, and thus at the mercy of the currents and surface drift. The suitability of these is important for the keeping up of the stock, as the latest larval stage has to fall on the bottom in a few feet of water of not less salinity than 17 $^{\circ}/_{\circ\circ}$. Thence the young plaice gradually extend into deeper water, *the size and age of the plaice in any part of the North sea being directly proportional to the distance of the locality from the coast and its depth.* This law is not true for the Dogger Bank, which, being covered by several fathoms of water, is unsuitable to the first bottom stages, and, being surrounded by relatively deep water, can only be reached by the largest fish, for whom it forms an excellent feeding ground. The above law, indeed, may seem only an expression of the topography of the North Sea, but Borley considers that the size of the plaice present is due to the suitability of grounds of different depths to the nourishment of plaice of different sizes, deeper waters providing the nourishment suitable to larger fish. The Dutch coast is the great plaice-nursery, and the density of young fish there is out of all proportion to the amount of food. Statistics of catch show that rough, stony, and muddy silt areas are much poorer than sand areas of the same depths. After spawning there is a dispersal of the spent fish, these often extensive wanderings being feeding migrations. Then there is a rest period in the winter, almost a hibernation on top of the sand, before the next spawning migration commences.

The plaice has its southern limit at the British Isles, isotherm 10° C. To the north there are extensive fisheries at Iceland and in the Barents Sea. Spawning takes place to the south-west of Iceland, and the larvæ are carried to the north coast, to return when mature to the ground where they were spawned. In the Barents Sea there is similar movement from west to east and east to west, in each case the breeding migration being to warmer water. In cold regions growth is much slowed, a fish of 40 cms. from the North Sea being six years old and from Barents Sea about eighteen. The latter agrees rather closely with the growth of the Baltic fish coming from an area of low salinity, and some observations suggest that growth can be retarded either by cold or by low salinity. This size and age, too, are about the limits for the Baltic, whereas fish of 70 cms. and fifty years of age have been caught in Barents Sea.

* This estimate of Heincke's will probably have to be revised after further consideration of the English statistics.

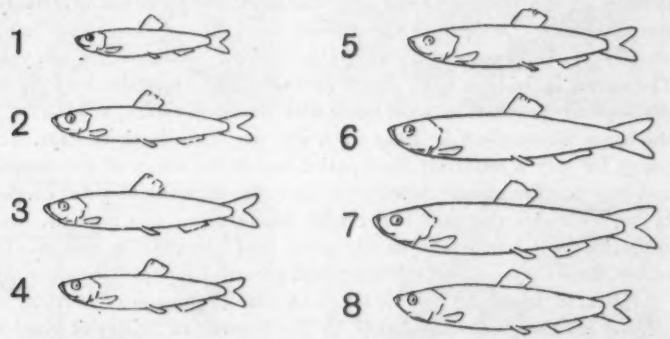
The plaice in Barents Sea, after spawning, follow the eastern spread of the warmer and more saline Atlantic water, and catches have frequently been obtained from such water flowing as undercurrent under the colder and much fresher Arctic water. Pettersson has shown how the flat fishes follow the seasonal invasion of the Baltic by undercurrents of Atlantic water. In the spring, which is hydrographically midwinter, there is an immigration into the Kattegat of ten northern fishes, and in the late autumn one of eighteen southern fishes, these two immigrations being correlated with cold and warm undercurrents. Plaice lay each about a quarter of a million eggs of about 0·07 inch in diameter, rather pitted and corrugated on the outside. These float close to the surface in the North Sea, but have been found confined to this Baltic undercurrent, which has a temperature of 5° to 6° C. higher than the layers of water above and below. This is probably a correlation with viscosity rather than specific gravity, the decrease in which from the bottom to the surface is relatively small, while viscosity increases by about 2 % for each fall in temperature of 1° C. This is a factor which has as yet been little considered as aiding in the flotation of eggs and larvæ, but it is probably of importance; practically its entire dependence is on temperature.

The cod is the dominant demersal fish on all northern grounds, extending west of the Atlantic to the Newfoundland banks, where there is an immense fishery; to the south it is replaced by the hake. It prefers a rocky bottom, but is found over the sandy grounds, though here among round fishes the haddock has first place. Spawning takes place on the offshore banks of Norway, of the Færoes, and of South Iceland at a depth of about 50 fathoms. Spawn is also shed at a lesser depth round Ireland and Scotland and in the North Sea, but there are no immense spawning shoals as in other localities. This distribution at the spawning season, February to April, indicates a correlation with temperature areas of about 6° C. After spawning the fish spread over the banks in every direction, and marked fish have been known to cover a distance of 300 miles in five to six weeks. Many spent fish in shoals pass up round the north of Norway to the eastern ice, and in suitable season to Spitsbergen and Novaya Zemlya, subsequently returning for their next spawning.

The eggs and larvæ of the cod, like those of the plaice, are passively distributed by the currents round the north of Iceland and over Barents Sea, local stocks being left in the bays and fjords. They grow up experiencing temperatures of 0° to 7° C., salinities of 36 $^{o}/_{oo}$ to 20 $^{o}/_{oo}$, or even less, and depths of 0 to 200 fathoms. They join the spent fish from Norway in the pursuit of the capelan, a real Arctic fish, which follows the retreating ice, and when seven or eight years old accompany them to the west, their first spawning migration, being now about 2 feet long.

The herring is economically most important of all fish, being fished all round our coasts to Iceland and Norway, forming half of the total

value of fish from the North Sea. The sequence of its appearance on the East Coast from the Færoes in spring to East Anglia in late autumn is a matter of common knowledge. Essentially it is a coastal fish, not wandering far over the Atlantic, and breeding in coastal areas in March and April and in the late summer. The fishing is by drift nets, stake nets, shore and purse seines, all nets into the meshes of which the herrings drive their heads, and by trawls (less than 5 per cent. of those landed in East Coast ports) dragged at 4 to 6 knots a little off the bottom. The herring shuns the light, rising and falling vertically in the water by night and day, so that the first method is mainly pursued at night and the second only in the daytime. It differs from the plaice and cod in that it is not a bottom feeder, but depends on the floating and swimming life of the upper waters, which it at times filters out by what are known as its gill-rakers, and at other times actively pursues, selecting



RATES OF GROWTH OF HERRING. EIGHT FISH OF EQUAL AGE (FOUR YEARS) FROM

1, WHITE SEA;
2, LYSEFJORD, NORWAY;
3, ZUYDER ZEE;
4, EAST COAST OF SWEDEN;
5, WEST PART OF NORTH SEA;
6, ATLANTIC OCEAN;
7, ICELAND;
8, WEST COAST OF NORWAY (SPRING HERRING).

(*After Hjort.*)

particular organisms. Its movements are food migrations, and the study of these leads to the correlation of the food animals with floating plants, and so to the hydrographic conditions of the sea-water on which these depend.

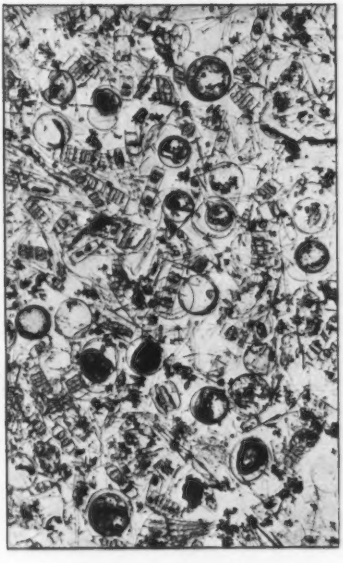
A more direct connection with the physical conections of the sea is seen in the composition of the herring-breeding shoals, the individual fish of which can be analyzed for age by the rings in their scales. A baby herring has precisely the same number of scales as a mature herring, and the scales persist throughout life. Growth takes place in the period of maximum abundance of food, from April to September. It is represented on the scales by a broad transparent ring, while the period from October to March, which exhibits no increase in the size of the fish, has six months' solid scale matter concentrated into a narrow, sharply defined

opaque ring. The breadth of the summer ring clearly indicates the amount of growth, and this depends on the abundance of the right kind of food. The differences in rates of growth are obvious, the increase of weight of a herring from an open coast being at least twice as great as one taken from closed water, such as the White Sea, Baltic, or Zuyder Sea, which of course are less saline and have greater annual ranges of temperature. Differences are also visible in favour of areas which directly abut on the Atlantic, the Iceland and our western fish being of especially remarkable size.

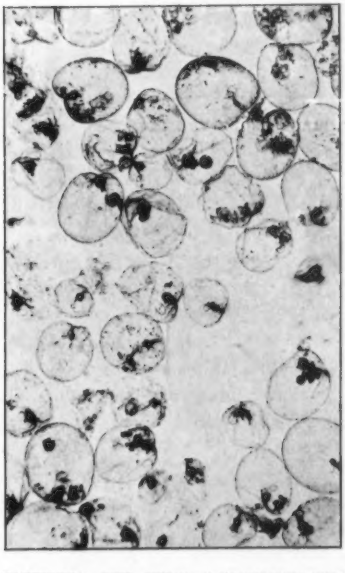
By the study of the breadths of the summer rings in scales, the areas where herrings spent their previous lives may be ascertained. A breeding shoal of mature fish, all of about the same size, may thus be analyzed, not only for the ages of its individuals (expressed usually by the year in which they were born), but also for the places in which they were reared. Most individuals of a shoal are from the same area, but there are invariably a few stragglers. A few are three years old, most only becoming mature at four or five years, in unfavourable regions taking six to ten years. The spawn is laid on hard rough ground, attached to the bottom, and development proceeds in accordance with the temperature, at about 3° C. the hatch taking place in forty days, and at 12° C. in eight days. The young for only a relatively short period are at the mercy of the currents, and their further growth depends on the areas to which they are carried; in our estuaries they are found with young sprat as whitebait. Real migration only commences on the close approach to their first breeding season, when they seek out suitable rough grounds for depositing their eggs.

Hjort, to whom we owe so much of our knowledge of herring, has pointed out the great importance to the Norwegian fishery of the 1904 class, viz. the brood of 1904, its dominance in the marketed fish since that year. In 1908 it represented 35 °/₀ of the catch, 77 °/₀ in 1910, and 65 °/₀ in 1913. It has made the Norwegian fishery in these years remarkably successful, but its position is now being challenged by the 1908 and 1909 classes, which were excellent. The 1904 class is now passing, but it may be predicted that the 1908 and 1909 broods will ensure a successful fishery for several years. Hjort also showed the excellence of the 1903 and 1904 cod classes, the age determined as for herrings by scales. Yet these years were amongst the poorest in amount of spawn, so that this clearly is not the cause of their dominance. They were, however, remarkably late years for spawning, and the young of both the cod and herring met with an abundant supply of the minute floating plants on which they feed; the temperature at which the fish eggs hatched was higher than usual, a circumstance favourable to the pelagic plants. The currents, too, on account of the lateness of the brood, were more determined, and there would thus have been an avoidance of that great mortality which usually is found, at least in eggs and larvæ, where cold and warm currents meet.

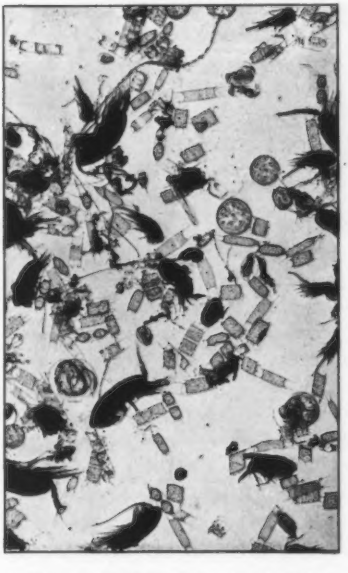
FLOATING PLANTS, MAINLY CERATIUM.



DIATOMS AND A FEW FISH EGGS.



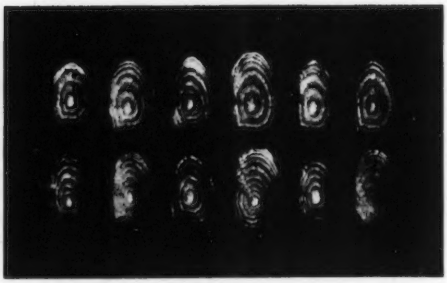
NOCTILUCA, THE CHIEF PHOSPHORESCENT ORGANISM.



LARVÆ OF CRUSTACEANS AND DIATOMS.

FLOATING LIFE OF THE SEA.

(Greatly magnified.)



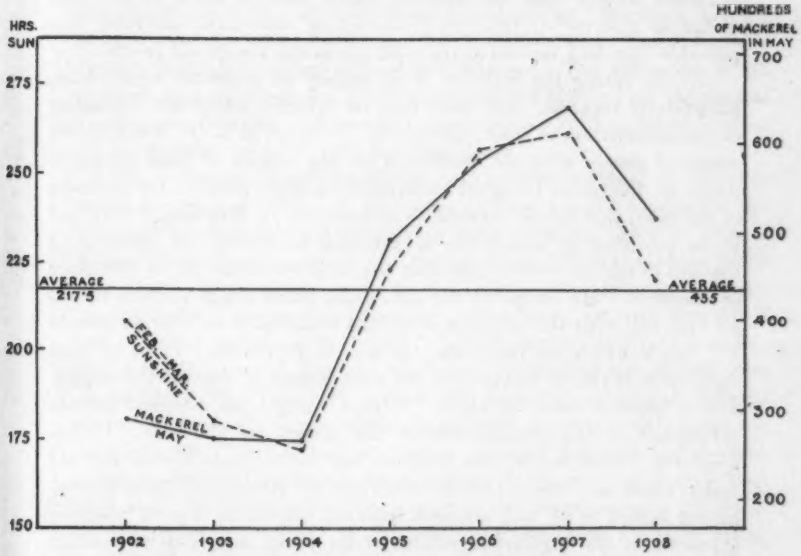
OTOLITHS OF MATURE FEMALE PLAICE.

Upper row—Otoliths of plaice from West Bay (English Channel); Lower row—Otoliths of plaice taken in the region of the Leman Banks (North Sea).

HERRING SCALE WITH EIGHT WINTER RINGS INSIDE THE EDGE.
(*Lea, Phot.*)

SCALE OF COD WITH FIVE WINTER RINGS.

The mackerel has points of resemblance to the herring, and is caught by the same means. It has three varieties: a West European, ranging from the Canary Islands to Norway, but cut off from Iceland; a Mediterranean form extending into the Black Sea; and an American form appearing from Cape Hatteras to the St. Lawrence.* It spawns on the Atlantic coasts everywhere in May and June. Whence the spawning shoals come is not known, but from their simultaneous appearance and maturity of genital organs we may deduce that they have all been living in regions with similar hydrographical conditions. This view is supported by the



CORRELATION OF SUNSHINE IN FEBRUARY AND MARCH, WITH CATCH OF MACKEREL IN MAY.

(*After Allen.*)

earlier breeding of the Mediterranean form, which lives in water which earlier becomes warm.

Besides the breeding migration there are the seasonal migrations of the young fish, as shown by their shoals appearing off Cornwall in January, Sussex in March, and Suffolk in May. Their appearances are rather irregular, as they travel on the surface, in midwater, or near the bottom. Probably they keep to the Atlantic water coming in as an undercurrent and carrying their food, their sudden appearances near the surface here

* Nilsson considers that there is a fourth variety from Swedish waters. He also points out that the distribution of eggs is mainly a question of salinity, which must be not less than 26 ‰.

and there being due rather to the upwelling of this than to the influence of light. In any case, the success of the Channel and North Sea fishery seems to be correlated with an extensive inflow of warm saline water. Other shoals enter the North Sea round presumably the north of Scotland. The floating eggs of the mackerel are dispersed over all areas of our banks where the adults are found. After spawning the shoals break up, a general dispersal, the food now being principally the young of other fishes. In November and December all disappear, and no one knows whither they go. Remembering how intensively the shallower waters near the land are fished over, it seems certain they spread far into the Atlantic, and, considering their shape and form, it is probable that they become as truly pelagic as the tunny and bonito.

In the spring the mackerel feeds largely on midwater crustaceans, particularly copepods, and these feed on diatoms, which are dependent on the assimilation of their chlorophyll. It occurred to Dr. Allen, in the course of purely scientific researches on the culture of these plants, in which he discovered the great importance to be attached to the intensity of the light, that special abundance of copepods in May would have had to be preceded by abundance of sunshine producing rich cultures of diatoms in earlier months, and that this might be reflected in the catch of mackerel. He compared the data from three steam drifters fishing off Cornwall with the sunshine, with the remarkable correlation seen in the figure which he has permitted me to reproduce. Proof of such correlation is yet far distant, but we must regard as hopeful the suggestion of physical data, by which "drifters" might be informed months beforehand of the probabilities of the fishery for the year. Hydrographical changes are of slow progress, and in our areas can be foretold many weeks beforehand by observations in the Atlantic. The mackerel, having regard to its long absences from our waters, its regular breeding appearances, the regular migrations of its young fish, and its possibly illimitable numbers over the deep sea, would seem to be a most hopeful case where the study of hydrographical conditions should lead to important economic developments.

The freshwater eel is found in *all* European waters, and in most countries it is a valued luxury, being regularly fished in fresh and brackish waters by traps of different sorts. In autumn the best and fattest are obtained as they wend their way downstream to the sea, having put on a silvery dress in contrast to the yellow of those that remain. Their further history was quite unknown until recent years; but now it has become clear that they migrate gradually seaward to some depth over 500 fathoms, where their generative products are shed into the water to fertilize each other. The ova, the number of which must be vastly greater than that of any other fish, are exceedingly small, and it is necessary that an animal capable of fending for itself should be formed as quickly as possible. This stage has been identified with very

thin, transparent, ribbon-like fish without fins, about 7 cms. long, to which the name *Leptocephalus* has long been given. It is caught in fine silk nets down to several hundred fathoms, but in greatest abundance at 50 fathoms. It is found far out in the Atlantic in May, but nowhere north of the Scotland-Iceland line, and over no water of less depth than 500 fathoms, the temperature at this depth being about 7° C., and having a salinity of 35·2 $^{o}/_{oo}$. It is for this reason that it is considered that the migration must be to a depth of over 500 fathoms; but it may be at two, three, or more times this depth where the mature fish spawn. This indeed is probable, for there must be a whole series of changes from the minute egg to the relatively large *Leptocephalus*. We know nothing of them, and by inference we are led to believe that they are passed through floating in water of over 500 fathoms. The differences in the physical conditions between the Thames and 500 fathoms off the west of Ireland are, however, sufficiently remarkable to kill any other kind of animal of which we at present have cognisance.

The *Leptocephalus* is of nearly the same specific gravity as the Atlantic water in which it lives. It can swim a little, but it remains for the most part suspended in the water, thus being subject to the Gulf Stream. It may live to some degree on the minute plant life of the water, but it eats little. While being swept to the coasts, it rearranges its body, ceasing to be a ribbon and becoming a little round eel with fins, 6 or 7 cms. long, now known as an "elver." In November these are found on the Atlantic coasts of Europe, round by the west of the British Isles to Iceland. They begin to ascend into the fresh waters of different countries, probably in accordance with their temperatures. Some are swept up the Channel, and some cross between Scotland and Iceland. A few appear off Denmark in the following March, and two months later they enter the Baltic, which their parents left twenty months before on their long breeding migration. Economically these facts are made use of, for Danish waters never carry as many eels as they can, and millions of elvers are annually imported to stock them. However, the interest to us is in the peculiar correlation of the young stages to physical conditions quite different to those in which the parent feeds and grows, and in the complete dependence of the eel-fishery of Western Europe on the regular flow of Atlantic water to its shores.

After this consideration of these few instances, it will be abundantly clear that the lives of our fish are mainly governed by the conditions of the medium in which they live. These conditions, which are beyond human control, act by their fluctuations in producing good and bad years, and by their periodicity in producing successions of good and bad years. The destructive forces of nature become of proportionately less importance with the increasing age of different fish; in their greatest intensity they can conceivably only be partially overcome by closing off especially favourable areas for the youngest fish in every region, but

as yet we do not know any practical means of reservation of such areas.

Man's action in the North Sea has become such as to destroy the balance of nature, acting as it does principally on the mature fish, lessening their number, and so the amount of spawn to produce the next generation. It can be controlled, but only by international agreement, for which there must be a foundation of incontestable evidence. The collection and dissemination of meteorological data is managed for West Europe by a central body, and in 1902 the "Conseil permanent international pour l'Exploration de la Mer" came into existence, England, Scotland, Belgium, Holland, Germany, Russia, Denmark, Sweden, and Norway being members, France, United States, and Ireland coming in later. The conferences of the representatives of these countries have been both amicable and highly profitable in the investigations of the economic problems of fisheries, depending as these do on immense and fundamental scientific problems.

It is clear now that the plaice stock of the North Sea is being so seriously depleted by man, that a plaice fishery in that region may well be in a few years a thing of the past. This can be largely remedied by putting a size limit on the plaice sold, so that fishing in Nature's nurseries is not profitable. Six inches has been the limit recently proposed as least interfering in the first year with the fisheries of different countries, there being little or no subsequent loss, but a limit of 9 or 10 inches is really required. In the excellent years which are bound to follow the present closure of the North Sea to trawlers, such a size limit would not be felt, and is therefore a matter of practical politics. In any case, it is to be hoped that, in the economy which must be exercised in all European countries after the war closes, be they belligerent or neutral, this valuable International Institute for the investigation of our fishery regions may be maintained. Any international agreement is useless unless all neighbouring countries are signatories, and this matter of the food of a vast number of the human race of many countries is too important to be the play of political forces, a fact which should be first recognized by France, Germany, and Britain, as being great business nations with large populations and vast fishery interests. Furthermore, in the extension of such international institutions lies the best hope of permanent peace.

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A. General.—The annual and scientific reports of the English, Scotch, and Irish Fishery Boards; the publications of the Conseil permanent international pour l'Exploration de la Mer, including 'Rapports et Procès-verbaux,' 'Bulletin Trimestriel (Hydrographique, Planktonique),' etc., 'Bulletin Statistique,' and 'Publications de Circonstance;' also 'Mémoire sur les Travaux pendant les années 1902–1912,' August, 1913; *Journal of the Marine Biological Association*, periodical;

annual report of the Lancashire and Western Fisheries District; see also 'The Depths of the Ocean,' by Sir John Murray and Dr. Johan Hjort, 1912, and 'Conditions of Life in the Sea,' by James Johnstone, 1908.

B. SPECIAL.—1. *Hydrography:* D. J. Matthews, 'North Sea Fishery Investigations, Southern Area,' Cd. 5546, 1911; D'A. W. Thompson, 'Idem., Northern Area,' Cd. 4893, 1909; other Bluebooks by same authors and publications of Conseil permanent, in particular those by Otto Pettersson, B. Helland Hansen and Martin Knudsen; also Hans Pettersson, 'Long Periodical Variations of Tide-generating Force,' Pub. de Circonstance, No. 65. 2. *Plaice:* Friedrich Heincke, 'Rapports,' etc., Oct. 1913, and A. T. Masterman, 'Rapports,' etc., several reports, also Bluebook in press. 3. *Cod and Herring:* Johan Hjort, 'Rapports,' etc., 1914, and several publications by other authors in same series. 4. *Mackerel:* E. Ehrenbaum, 'Rapports,' etc., 1914; E. J. Allen, *Journ. Marine Biol. Ass.*, vol. 8, p. 394, 1910; D. Nilsson, Pub. de Circonstance, No. 69, distributed April, 1915. 5. *Eel:* Johs. Schmidt, 'Rapports,' etc., 1906 and 1914.

The PRESIDENT (before the lecture): Prof. Stanley Gardiner, who is going to lecture to us to-night on Sea Fisheries, is an old friend of the Society. He is now Professor of Zoology and Comparative Anatomy at Cambridge. For the last twenty years he has been doing oceanographical work of different kinds in the Pacific Ocean, the Indian Ocean, the Maldive and Laccadive Islands, and elsewhere, and the results of these travels he has brought back to the Society, from which he received the Murchison Award. Prof. Gardiner is now a member of the Government Advisory Committee on Sea Fisheries. This has led him to investigate the very important question of the distribution of fishes, and some of the results of his more recent work he will communicate to us to-night.

Lord LUCAS (after the lecture): I have long known Prof. Gardiner by reputation as having been one of the keenest and most learned of the students of this great science, and as having been one of the men who stands out among the many scientists to whom we at the Board of Agriculture and Fisheries owe a great debt of gratitude for the way in which he has put his great knowledge and his time and services at our disposal. I am very glad to be here to-night to express our thanks to Prof. Gardiner. We have had a great deal of work from him on the Advisory Committee on Fisheries Research, and since the war broke out Prof. Gardiner has been studying on our behalf a number of fisheries questions arising out of it. I am sure every one who has heard his lecture to-night will agree we could not have had better assistance, we could not have chosen a better or more skilful scientist to help us in these matters, and we owe a great deal to him for the work he has done. May I be permitted, also, to express my pleasure to-night that the Royal Geographical Society has interested itself in the question of the fishing industry of this country? The figures with which Prof. Gardiner opened his lecture to-night show what a gigantic industry it is—an industry which employs 125,000 men, in which there is invested a sum which he estimates at £200,000,000, is indeed a large industry; but from the very nature of it, except those few people who happen to come into contact with it at the ports where it is carried out, the country as a whole has very little knowledge about it. All they know, as a rule, is that the price of fish varies from day to day. Bad weather produces bad fishing, and seasonal conditions generally affect the supply. Sometimes, for instance, for no reason that we know of positively, we learn that the herring fishing has been a failure, because the herrings have chosen not to follow their usual route. We know nothing, or next to nothing, about the conditions of hardship under which this industry is followed. The photograph we saw to-night of those men fishing in the Barents Sea is probably

something perfectly novel to most people. The fact that all the year round we have trawlers going to that most dangerous and most difficult of seas and catching fish under conditions of the greatest hardship is unknown to the majority of people in this country, and I should like to express our gratitude to you for the line you have taken in allowing a good deal of to-night to be devoted to a discussion of this great industry. I think the thing that is bound to strike one most in listening to Prof. Gardiner's lecture is the importance of the discoveries made by means of scientific investigations with regard to the habits and movements and the growth of fish. One cannot help feeling that the time will not be very far off when we shall have something like a really exact knowledge of the development of fish. As he tells us, you have good seasons for fish and bad seasons for fish. The two industries with which I am particularly connected at the present moment, agriculture and fisheries, seem to me to have a good deal in common. Both are dependent to a great extent upon the weather; both are dependent upon the conditions of any particular year, and as our knowledge of these things increases, so we shall begin to estimate with greater certainty the catch of fish that is going to be brought to these shores every day, and so we may hope to secure the permanence of the supply of fish for the markets, not only of this country, but the markets of the world. At the end of his remarks Prof. Gardiner mentioned the scientific investigations which have been carried on for a number of years by—to give it its right name—the International Council for the Exploration of the Sea. It is one of those international bodies which by its very nature and composition is apt to move rather slowly. It has representatives on it of almost all the Western Powers of Europe and the United States, and unfortunately, of course, the war has upset it as it has upset many other things. I am glad, however, that although its operations are for this year seriously curtailed, it is only in a state of suspended animation, and we hope that with the advent of peace the Council will be able to resume its work with all its old vigour. I am convinced that the work which is being done by that body, the systematic exploration of all the problems of the sea, is the one thing that is going to bring us conclusive results on all these problems. The share that this country has taken in the work has been, at any rate on one side of it, satisfactory from our point of view. I think we can say that the British representatives have supplied a great deal of initiative, have undoubtedly done a great deal to co-ordinate the work, and have contributed the greater part of the statistical work which is so necessary on a subject of this kind; but of the other side of the work, the work which is a necessary corollary to that, namely the work of the sea investigations, I am sorry to say we have not perhaps borne a pre-eminently great share. I am afraid England at the present time is the only country which has not got a properly equipped fishery research vessel of her own, and I can only say I sincerely hope I shall continue in my present office long enough to see that evil remedied. I do not think any reference to the subject of the fishing industry would be complete without some mention of what is being done at the present time by the fishermen of this country. Of all those who are assisting the country at the present moment with their services there is no class whose doings fall so heavily under the ban of the censor as does the work which is being done by our fishermen at the present time. But I am perfectly convinced, when the time comes, when the seal of secrecy can be removed, and when the doings of our fishermen, assisting the Admiralty as they have done, volunteering in large numbers for the navy, supplying a great part of our mercantile marine, as they habitually do, when the whole of their works have been brought to the notice of this country, I am sure we shall realize that the fishing industry is second to none, first of all as an industry of economic importance, and secondly as breeding the most virile class of men this island can produce.

Sir Norval W. Helme: I have the honour to-night of seconding the vote of

thanks that has been proposed by Lord Lucas. I do so with particular pleasure because I had the opportunity of serving with Prof. Gardiner some years ago on a Parliamentary Committee, when the question was referred as to whether the Government should continue its grant to the International Committee for the purpose of the scientific study of the life and conditions of the fisheries in the North Sea. The matter of food supply has engaged the attention of the people of this country for many years, because of the great increase of population we have had during the last century, and the needs to provide good and wholesome food for the people. During the last few years arrangements have been made by which local authorities around the coast might become responsible for the oversight of the fisheries along the shores of the country, and so it is that the two departments, national and local, stand out as part of a great interest for supplying the people of this country with the food that is so good, namely, those that fish in the wider seas, and those that fish in the territorial waters around our shores. There is, unfortunately, a great feeling of competition between the inshore fishermen and those who trawl in the larger ships, and at the present moment we find that whilst the one is extending and has already attained the enormous proportions that have been mentioned by the lecturer, the supplies got by the inshore fishermen have been gradually becoming less, and so it is that the Government appointed a Departmental Committee which met last year to consider what could be done for the benefit of the inshore fisheries. Looking at the question as a whole, I would point out, in the presence of Lord Lucas, that the report of the committee on which Prof. Gardiner served has been upon the shelves of the department for some seven years since that report was made, and comparatively nothing has been done. At the present time, when we are having an income tax of 2*s.* 6*d.* in the pound, and other terrible consequences of the war upon us, we can quite excuse a Government Department for not hurrying up some recommendations which involve expenditure of money, but we do require legislation, and, as the report suggested, there should be concentration at headquarters in the oversight of the management of our fisheries. Owing to the arrangement by which the affairs of England, Scotland, and Ireland are administered separately financially, the different countries spend different amounts of money obtained from different sources in support of their fishing industries, and what was recommended by that committee I think is worthy of special consideration at the present time, because if we had a united council, I think we should have greater unity in carrying out the great measures that might affect the fishing around our shores. There is no doubt if the scientific study is supported by the Government we shall have greater advantages in the future. Locally, in the north of England, if I may venture to give one illustration, the Lancashire and Western Sea Fisheries Committee have invested money and provided a vessel of their own, to do what the Government has hitherto not attempted, to undertake the scientific study of waters around our shores, and it is by this work Prof. Herdman has given great help in directing the scientific efforts of the local sea fisheries committee, and great good has been done. In addition to the fishes of which Prof. Gardiner has spoken to-night, there is the great shellfish industry, and that requires careful support, and it was a matter of interest to have put before us when that committee took evidence (Prof. Gardiner will remember the evidence). It was shown that by the investment of a little money and effort on the part of those connected with the mussel fishery it produced enormous advantage, because owing to the fact that in the seaweed attached to the rocks on the seashore there are thousands of small mussels which only require transplanting and having more room given them in which they could grow, the increase in the size of the fish was enormous, so that a tremendous addition was made to the

available food supply. I have only ventured to allude to these points, but of course I recognize it is an opportunity we do not always get to bring a little pressure to bear upon the head of a Government Department when we are meeting outside the Houses of Parliament—in the presence of the Geographical Society—and I do think we may, at any rate, press the Government to consider further some suggestions that have been made. Prof. Gardiner alluded to the fact that out of 500 millions of plaice that are gathered only 200 millions are available for food, 300 millions are killed and wasted because of the method that is adopted in the taking of the fish. We must have a law passed to prevent the taking of immature fish. If we could have that, I think it would tend to allow the increase of the fish to be continued at an increased ratio, because the destruction of so many of these young fish naturally affects the home supply available.

Prof. E. W. MacBride: I have much pleasure in supporting the motion of thanks to the lecturer for his most interesting lecture. It was also a very great pleasure to hear Lord Lucas, who discoursed so eloquently upon the subject of the necessity of scientific investigations in matters relating to fish, and I think, as a practical zoologist, the question immediately arises, the condition of the fisheries being what the lecturer Prof. Stanley Gardiner has indicated, how can they be helped by scientific people? It seems to me the scientific zoologists might try to do three things: First, they might try to help the fishermen to find the fish, and I suppose that is one of the main objects of the investigations which have been so heartily commended by Lord Lucas, because we know that fish in different years pursue different courses. We know that sometimes when the mackerel come up the Channel they strike the coast in one place and sometimes in another, and the fishermen sometimes suffer a complete loss through ignorance of where to look for the fish. If we were able to tell them where they would be likely to get the fish such loss would be avoided. Secondly, they might endeavour to prevent the depletion of fisheries by over-fishing. I was shocked to hear the rate at which the plaice fishery was being worked. I had not got any idea that we were approaching so near the limits of our supply. The fishery for halibut on the other side of the Atlantic —on the western side—was pursued by large fishing boats on the coasts of the eastern states of the Union. They fished out the halibut banks so completely that it no longer paid them to work there. They then paid their attentions to the Pacific coast, and actually invaded the inlets of British Columbia, and shipped the fish a 3000-miles journey by land and sold them in the New England States. The fishery, therefore, off the eastern coasts of the United States was almost depleted, and what has happened there might happen here. Thirdly, they might examine whether, in any way, it would be possible to increase the stock of fish artificially. I think what Prof. Gardiner has shown us to-night will convince most people of the utter futility of attempting to increase the stock of fish by the artificial hatching of eggs, and then letting the fish-fry escape into the sea. When one thinks of all the millions of fish eggs found over the enormous area occupied by the fisheries, one would realize the futility of trying to increase the stock of fish by throwing two or three million eggs a year from some local spot into the sea. I feel greatly encouraged by the kind and sympathetic way in which this motion for a vote of thanks has been proposed by the head of the Board of Agriculture and Fisheries.

Mr. H. G. Maurice: I am not quite sure whether it is in order, under ordinary circumstances, for an administrative officer to speak in the presence of his President [Lord Lucas], but I have my President's kind permission. I am going first, if I may, to refer to those counsels of perfection which Sir Norval Helme has been giving us. He has suggested to us we should have a united authority for fisheries, and by a

united authority I know he means an authority which is responsible for England, Scotland, and Ireland. Well, I admit that that is a counsel of perfection, but I would remind you of two things. The first is, that we have recently passed a Home Rule Bill, and the second, that Scotland is very tenacious of its own authority and rights—as also is the Lancashire and Western Sea Fisheries Committee—and I suggest that the first result that would ensue from the constitution of that united authority would be a number of broken heads. We have seen it discussed in various connections, and I am afraid the united authority is as far off as ever it was. There is no reason why we should have no vessel of our own; Sir Norval Helme has told you that we have done nothing. That is an over-statement of the case. The President of the Board has said that we have not got a ship of our own. In so saying he stated no more and no less than the precise truth. We are not the owners of a ship, but I look forward to the time when we are able to bring the necessary pressure to bear on the Treasury to enable us to get that ship. Meanwhile, we have been hiring ships and doing a very large amount of sea-research work, and, standing here to represent the administrative side of the Board of Fisheries, I cannot allow the challenge to pass or admit that we do not do a great deal. Sir Norval Helme referred also to the question of immature fish, and expressed the horror we all feel at the amount of waste which takes place. He said we must have legislation to stop it. One of the objects of our scientific investigations is to find out how you can achieve that. Up to the present nobody has been able, so far as I am aware, to devise a trawl net which will enable you to take the mature fish without destroying a large proportion of immature. I know a great many experts are in favour of legislation to regulate the size of the mesh, so that it will allow immature fish to slip through, but, speaking with all deference in the presence of experts, I believe I am right in saying, that the mesh which will let through, we will say, the immature plaice, or the bulk of the immature plaice, will also let go the mature sole, because the sole is rather remarkable—he can compress himself into a narrow space without inconvenience to himself, and he will escape though of marketable size, while the plaice you wish to liberate may even remain in the net. So much for those points. I wish now to refer to one point which Prof. McBride made. He referred to the futility of attempting to increase the stock of fish by hatchers, and releasing a quantity of fry in the very vast area of water with which we have to deal. I am not going to enter into a discussion of scientific problems, but there is one point which we have thought may be worth considering seriously, and that is the extraordinary growth of plaice transported from the nursery grounds to the Dogger Bank. If we could only devise some means by which the plaice which were transplanted could be protected internationally, that is to say, if we could prevent one group of fishing vessels coming in and (if I may use a colloquialism) scooping the lot while the others were waiting for them to grow, I do think an experiment of that kind would be worth trying. So far, however, we have not been able to see our way to arrange such an experiment on lines satisfactory to all nations concerned. There are experts here whom you will be wishing to hear who can speak to you about the scientific details, and I as an administrative officer am always very anxious to steer clear as far as I can of the controversial lines of fishery science, but I want to emphasize the three points Prof. McBride has already put before us. We want to find out, if we can, to what extent it is necessary to protect fisheries, and having discovered that much, how they can be protected. That is object number one. The next question is, whether we can see our way to foster the development of fisheries—that is, to increase the abundance and improve the quality of the fish. That is an extremely problematical question. The third is what I may describe as the motto of the International Council, the rational exploitation of the sea—that is to secure the greatest possible catch without

detriment to the stock of fish on the grounds. All of those problems depend upon those physical geographical conditions which Prof. Gardiner has put before us this evening, and it is the study of that physical geography of the fisheries which is the groundwork, backed by statistics, of all our fishery investigations, and I think Prof. Gardiner was intentionally leading up throughout his lecture to the few words he said at the conclusion about the International Council for the Exploration of the Sea. The geography of the fisheries is a geography of physical conditions of environment, but there is also the topography to be taken into account. The physical conditions vary very largely with the topography, and the area we have to cover to get to the root of the matter is so wide that unless we can have the assistance of our fishing neighbours, we cannot possibly hope to cover it, to acquire that mass of information, and to sift that mass of information, which is necessary to lead us to true conclusions. I, personally, was extremely glad, and you appeared to appreciate the importance of the statement, when Lord Lucas said this evening that he looked forward to the time when under his Presidency we should be better equipped than we are at present for the purpose of these international investigations in which we have so important an interest.

Mr. F. Grant Ogilvie: One word I think is worth saying. I wish to offer congratulations upon a feature of this lecture that has not been referred to, but ought not to pass unnoticed. I thoroughly endorse all that has been said already as to the lecture itself; I wish, however, to draw attention to the audience. I think there is something absolutely novel and very satisfactory in the presentation of a lecture on this subject to such an audience. It is a well-known fact that in this country the national assistance to scientific investigation never gets very much in front of popular knowledge. Accordingly, until people at large get to know a little more about the sea, get to realize a little more fully that the sea is not merely a lucky bag —the prevailing notion is of this sort—and get to have some idea that the sea is worth investigating, we shall not have any real backing for the call for the support of scientific investigations. I hope there will be many opportunities for such popular illustrations of the leading lines of investigation as we have had to-night, and I am sure that an advance of the kind could not have had a better start than it has had this evening.

The President: Unless there is any other Fellow who particularly wishes to address the Meeting, I think the time has come when I ought to wind up the discussion by proposing the vote of thanks, in which I am sure we shall all cordially join, to Prof. Stanley Gardiner for the very instructive and interesting lecture he has given us. I am in the position of one of those who most needed instruction, for I knew nothing of fisheries except their products after the catch has come to dry land. I have looked with interest at the varied spoil of the sea ranged on the quays of Whitby, under the sheds by the Rialto in Venice, and, best of all, beside the long lanes of that wonderful place, the fish-market of Tokio. The display of fish to be seen there is, perhaps, the largest and the fish the strangest that one sees anywhere. Next to ourselves the Japanese are probably the greatest fishermen in the world, I have no doubt their practice as fishermen is one of the reasons of their naval efficiency. Of the close and delicate accuracy of Japanese representations of fishes every one familiar with their national art is well aware. What has struck me is the difference in the fishes of the different seas and oceans, how the fish-stalls emphasize the effect of environment on the development of fishes. I am sure this is a subject open to the investigations of many students—how all these fishes arrive at the weird forms in which we see them.

We have talked about the distribution of fishes; here again I must confess that my knowledge of their distribution is confined to that which takes place after they

are caught. But there are some picturesque incidents connected with it which have come to my knowledge in different ways. One I had from Mr. Spotswood Green, who has just retired from a high post connected with the Irish Fisheries. He told me that the Japanese war injured the fishermen on the west coast of Ireland because it reduced the demand at Petrograd, where the best lobsters were always sent. Again, in the north of Norway one may often get a good glass of port. This is due to the fact that the Norwegian boats which go down with cargoes of salt fish to Portugal before the Lenten fast, come back with port wine as ballast. Another incident of the same kind was told me by an eminent antiquary, who assured me that while digging up a Roman camp near Worcester, the shells of west coast oysters were found in the soldiers' quarters, but in the officers' quarters they were those of Colchester natives; an incidental proof of the excellence of the Roman roads in Britain.

We have not only to thank the lecturer to-night, but also to thank Lord Lucas, his fellow-officials, and the other speakers who have carried on a discussion which has been eminently practical, and may, I hope, have some permanent results in leading to these improvements in our provisions for fishermen and fisheries which have been foreshadowed. We offer our most hearty thanks to you, Prof. Gardiner, for the trouble you have taken in order to give us your lecture and to illustrate it so admirably.

SUESS'S CLASSIFICATION OF EURASIAN MOUNTAINS.*

By Professor J. W. GREGORY, D.Sc., F.R.S.

I. Current Classification of the Eurasian Mountain Systems. II. Prof. Suess's Classification. 1. The Primitive Nucleus. 2. The Altaid Zone. (*a*) The name Altaid; (*b*) The western Altaids; (*c*) The posthumous Altaids; (*d*) The eastern Altaids. 3. The Marginal Arcs of Eurasia. III. Discussion of the Classification. 1. The Value of the Foundation in Mountain Classification. 2. The Correlation of Europe and Asia. 3. The Relations of the Mountains of North-Eastern Siberia.

I. Current Classification of the Eurasian Mountain Systems.

The traditional view of the arrangement of the mountains of Eurasia represents the Continent as traversed from the Pyrenees to Java in the south-east and to Bering Strait in the north-east by a connected series of mountain chains, which includes the Pyrenees, Alps, Carpathians, and Balkan Mountains in Europe, the Caucasus, the chief mountains of Persia and Afghanistan, the Himalaya and various adjacent chains, the western mountains of Burma, and the disrupted chain represented by the islands along the south-western coast of Sumatra. The main mountain line of this series enters Asia from Europe with a southerly trend. It almost at once turns northward; and it is significant that the Caspian depression occurs at the angle formed by this sudden change in course. The northerly trend of the Asiatic lines is occasionally interrupted; but in eastern Asia it is well marked by the convergence of the eastern chains

* Royal Geographical Society, March 4, 1915

through the Yablonoi and Khingan Mountains into the single chain of the Stanovoi mountains in the north-eastern corner of Asia. South-eastern Asia is represented as based upon a divergent fan-shaped series of mountain lines projecting from Central Asia into Malaysia and southern China.

It was also generally accepted that the mountain loops which lie to the south of the great mountain backbone of Eurasia are offshoots from it. These loops are, first, that which surrounds the western basin of the Mediterranean, including the Balearic Isles, the mountains of south-eastern Spain, the Atlas, and the Apennines; second, the loop composed of the Dinaric Alps, Crete, Cyprus, and the Taurus; and third, the mountain arc of southern Persia, Baluchistan, and eastern Afghanistan. The mountains of the main band and its southern loops have various features in common. They consist of chains which are narrow in proportion to their length. Their crests usually rise in bold lofty peaks, and they are traversed by deep mountain gorges. The mountains are due to folds caused by compression, which generally acted in a meridional direction. In Europe the upper part of the crust has been thrust from south to north, but in parts of Asia the upper movement has been from north to south. The geological strike of the chains is generally parallel to their geographical trend.

To the north of this mountain backbone is a wide mountainous belt which as a rule does not present Alpine forms and has not been materially affected by modern folding. The valleys are usually wide and open. The grain of the country is often transverse to the trend of the mountains. These highlands have the features of an old topography, and they are geologically old. They may be of little importance as biological divides, and have often only a secondary influence on climate.

The northern mountain belt is represented in Europe by Brittany, the central plateau of France, the Black forest, the isolated hills which rise through the German plain, and the Valdai hills of Russia. In Asia their most important representatives are the lofty uplands of southern Siberia, northern Mongolia, and Manchuria; and from their northern foot the plains of Siberia descend to the Arctic Ocean, though some of the western parts drain to the Black Sea and the Caspian.

The striking differences between these southern Alpine Mountains and the older northern highlands may be appreciated by comparison of the Pyrenees with the moors of Brittany, of the Alps with the Harz Mountains, of the Carpathians with the Valdai hills, of the Caucasus with the Urals or the hilly steppes of the Khirgiz, and of the Himalaya with the Yablonoi Mountains.

Between the northern highlands and the younger mountain land to the south the level of Central Asia is often low, and it has in places even sagged below sea-level.

The mountainous belt to the north of the main mountain backbone of Asia has been classified on two main lines, according to whether the two mountain series are regarded as similar or dissimilar in type. The first

DIAGRAMMATIC SKETCH MAP illustrating

SUESS'S CLASSIFICATION of the EURASIAN MOUNTAINS

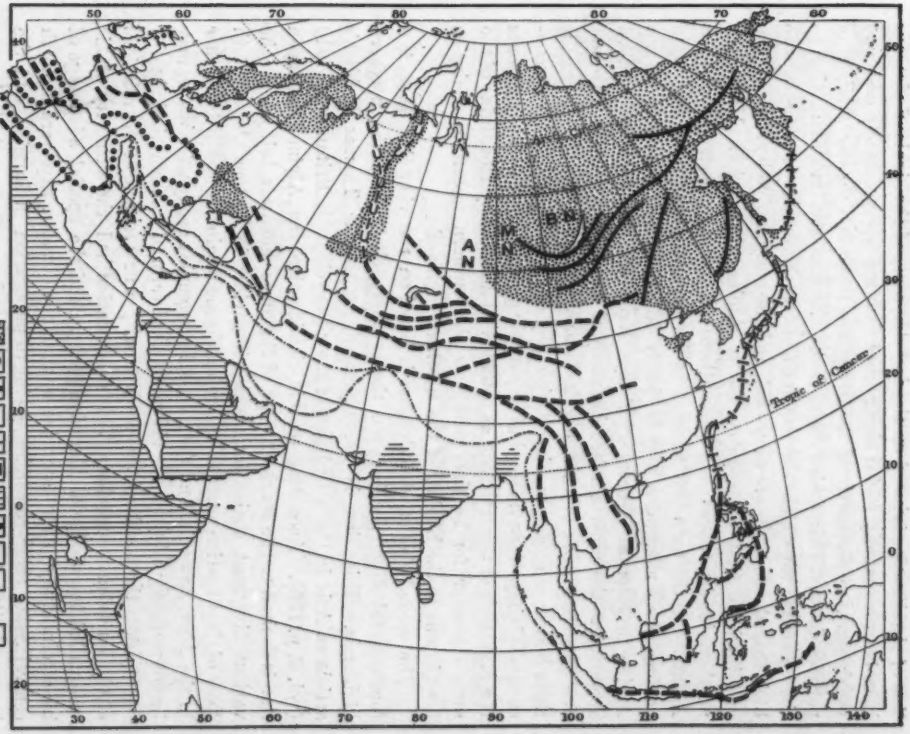
Scale 1:100000.000 or 1 Inch = 1578 Statute Miles

500 0 500 1000 Miles

Reference

Older Rocks of the Nucleus of

- Eurasia
- Uralids
- Altaids
- Posthumous Altaids (Alpids)
- Southern Marginal Arcs
- Eastern Marginal Arcs
- Southern Peninsulas
- Mountain Chains on the Nucleus
- Altaid Nucleus (Carboniferous) — AN
- Baikal Nucleus (Archean) — BN
- Minusinsk Nucleus (Lower Palaeozoic) — MN



line of classification is based on the fact that some of the highland plateaus have been repeatedly folded along lines running approximately east and west; thus, to the north of the Himalaya there is a regular gridiron of parallel folds. This folded band links the southern mountain line to the highlands, of which the mountainous northern edge is sometimes so high that the summits are snow-clad, and the marginal valleys are so deep and intricate that the country has an Alpine topography. Hence the northern border ranges like the southern chains have been described as Alpine. If the term Alp be used in its original sense for a mountain pasture, these mountains may be justly called Alpine; but they are not Alpine in internal structure. Prince Kropotkin has repeatedly called attention to the important fact that many of the Asiatic mountains are not due to modern folds, but are only the faces of plateaus. He therefore calls them border ranges. In his "Orography of Central Asia," * he demonstrates this important truth; but he possibly goes too far when he represents the highlands of Central Asia as bounded on all sides by mountains of the same character, for he thus interprets the southern mountain chains as homologous to the borders of the northern highlands.

The second line of classification is based on the view that there is a fundamental difference between the southern chains and the northern highlands. This view is well expressed, *e.g.*, in Sir Thomas Holdich's article on Asia in the last edition of the "Encyclopædia Britannica," 1910 (vol. 2, p. 735). According to this classification, the Alpine-Himalayan line is limited to the southern edge of the great mountain belt and to the various divergent chains into which it divides in eastern Asia. Both lines of classification agree in regarding the mountains as crowded together in the Alps, Armenia, and the Pamir, into complex groups, for which may be conveniently adopted the old-established term of "Mountain knots." †

In 1901, the late Prof. Suess advanced ‡ a new scheme of the relations of the Eurasian mountains. This classification had the authority of his unequalled knowledge of Eurasian geology and the special advantage of his careful study of the extensive work of the Russian explorers in north central Asia; their researches, owing to publication in Russian, and the inaccessibility of much of the literature, have been often overlooked.

Prof. Suess's classification has not been much discussed. There has been a tendency on the one hand to adopt it from respect to his high authority. It has, on the other hand, been still more widely ignored. It may therefore be useful to raise the question as to how far the new classification is useful and is likely to be adopted.

The exposition of Suess's views is attended by one great difficulty. They grew during the progress of his book, and it is not always evident

* *Geogr. Journal*, vol. 23, 1904, pp. 176–207, 331–361, maps, p. 280.

† This term dates at least from 1884. See, *e.g.*, 'Penny Encyclopædia,' vol. 2, 1834, p. 465.

‡ 'Antlitz der Erde,' vol. 3, part 1.

whether apparent inconsistencies are due to changes of opinion, or to the reader attaching undue weight to statements which were intended merely as reservations due to imperfect knowledge or as qualifications necessary to allow for local exceptions. At the risk, therefore, of some misinterpretation of his views, his classification of the Eurasian mountains seems to me essentially as follows :—

II. Prof. Suess's Classification.

Suess represented all Asia, except the peninsulas of Arabia and India, with part of Assam, and all Europe with the exception of the north-western coast of Norway and of the British Isles north of a line connecting the mouths of the Shannon and the Thames, as belonging to one geographical unit—the Asiatic edifice. This unit he extended westward

I. Diagrammatic Section across Europe

II. Diagrammatic Section across Asia

Primitive Nucleus to north and Archean Plateaus to south

Altaids

Alpids

across the Atlantic to include Newfoundland and the Atlantic coasts of Canada and the United States, and also extended eastwards across the Pacific to include Alaska and the eastern part of the western mountains of Canada.

The Eurasian part of this Asiatic edifice Suess regarded as formed of three constituents, which extend across the Old World from the Atlantic to the Pacific. The northern constituent is the ancient mass which formed the nucleus of Eurasia. The middle constituent is the broad zone of mountains which Suess calls the Altaids. The third constituent consists of the marginal chains, which are due to folding of comparatively recent geological age; the most important of these are the southern marginal chains which lie to the south of the Altaids, from the Balkans to Malaysia; of the eastern marginal chains the most important is the arc of Japan.

1. *The Primitive Nucleus.*—Prof. Suess called the northern mass "Der Alte Scheitel," * which has been translated in the Oxford edition as

* The French translation uses "Le Faîte Primitif."

"the Ancient Vertex." The term "vertex" implies a point or extreme summit, and, as was suggested in 1909, is not a very suitable term for an area which extends from Japan to Scandinavia. The term "vertex" is said to be based on the same word as "vortex." It is defined in the 'Encyclopædic Dictionary' (1899, vol. 7, p. 435) as "A turning-point; the principal or highest point; the top, the summit, the apex." The definition in the 'Century Dictionary' (vol. 8, 1889, p. 6736) is the same, except for the omission of "turning-point," and the insertion of "crown." That the vertex is essentially a point is shown by its use for the vertex of an angle, for the zenith, and in mathematics for the point of a figure most distant from the centre. Suess's "Scheitel," however, included northern Eurasia. Suess probably used the term with the meaning it has in Scheitelfläche, the surface of a plateau; and he therefore applied it to that vast area of ancient rocks which formed the primitive mass of Eurasia. As the continent grew by the addition of successive southern zones to the original mass, Suess's meaning would appear to be more clearly conveyed by the word "nucleus."* The 'New English Dictionary' (vol. 6, 1908) includes amongst its definitions of nucleus "a central part or thing around which other parts or things are grouped, collected or compacted; that which forms the centre or kernel of some aggregate or mass." Mr. Bailey Willis† has already used nucleus as the equivalent of Scheitel.

The primitive nucleus of Asia includes on its southern side a series of marginal folds of Palæozoic rocks which are concave to the north, while it encloses a large foundered area—the amphitheatre of Irkutsk. Attention was first prominently directed to these arcs by Cherski, who called them the Baikal, Sayan, and Altai arcs. The Baikal arc is recognized as the oldest, for it consists of Archean rocks which had, like the southern Highlands of Scotland, been crumpled into mountains by powerful pressure from south to north in pre-Cambrian times. Obruchev recognized the Baikal arc as part of the ancient belt which extended from the Sea of Okhotsk to the Altai, and separated two very different areas. To the north is the Siberian area, where Cambrian and Silurian rocks are predominant, and folds and fractures are weak; to the south is the Manchurian-Mongolian area, which is composed predominantly of Archean and plutonic rocks, and has been greatly disturbed by folds and vertical movements along fractures.

To the west of the Baikal arc are the mountains which Cherski called

* It might be objected from the commoner biological use of the word "nucleus" that it is essentially a small particle, and thus open to the same objection on point of size as applies to vertex; but the term "nucleus" was used in English for large masses long before its adoption in biology; it was apparently first used in English for the nucleus of a comet. In Latin it meant the kernel of a nut, so that the nucleus may be the larger part of a body. It is, moreover, thus used in biology, as for the nucleus or visceral mass of an Ascidian.

† Bailey Willis, 'Research in China,' vol. 2, 1907, p. 118.

his Sayan arc. Obruchev preferred to call it the Uigurian mass, after its aboriginal inhabitants. Suess pointed out that the Sayan arc is composed of two different elements. The eastern Sayans are western members of the Baikal arc; the western Sayans, which he has called the Minusinsk Scheitel,* are due to younger movements than the Baikalian, though they are of pre-Devonian age.

2. *The Altaid Zone.*—West again of the Minusinsk Sub-Nucleus is the third of Cherski's arcs, that of the Altai, to which Suess has attached special importance. He called it the youngest or Altaid Nucleus (Scheitel). To the south of it are a series of fold mountains of Upper Palæozoic age. These mountains Suess called the Altaids, and they and their fellows form, in his classification, the most important mountain element in the structure of Eurasia. Suess's Altaids do not correspond exactly with Cherski's Altai arc, which is Suess's Altaid Nucleus and the centre around which the Altaid folds were arranged. Suess's Altaids form the whole middle zone of Eurasia.

(*a*) *The name Altaid.*—The term Altaid is not altogether appropriate, for it is based not upon the main chain of the Altai Mountains, but upon their continuation in the Altai mining district of Siberia.

The term Altai is now applied to two dissimilar groups of mountains, the Mongolian Altaids and the Russian Altaids. The members of these groups are essentially different in composition, age, and structure. The Altai mountains of Mongolia form the great mountain line, 600 miles long, which is the southern face of the Archean plateau above the basin of the upper Irtish. The mountains of this line are the typical Altai mountains. Kropotkin, in the 'Encyclopædia Britannica' (11th ed. vol. 1, 1910, p. 758), calls them "the Altai proper," and says they are known also as the Ektagh, Mongolian Altai, Great Altai, and Southern Altai.

The Russian Altai consists of an area of mountainous country composed mainly of folded Palæozoic rocks, and it appears to have been originally adopted there as the name of a mining district. The name Altai is accepted for this district by various British authorities.† Some maps, on the contrary, such as those in Stieler's Hand-Atlas (1913, No. 57), and the map in Baedeker's Russia, do not use the term Altai for the Russian area, and limit it to Mongolia.

The Altai Mountains of Mongolia belong, however, to the Primitive

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* Suess's Baikal, Minusinsk, and Altaid Scheitel as sections of the greater Scheitel may be called sub-nuclei.

† *E.g.* Keith Johnston's Royal Atlas, 1894, includes it on plate 28, and on plate 29, Central Asia, the term Altai is not used for the Russian Altai, the chief member of which is marked as the Korgonsk range, and the Mongolian Altai is marked as the Bolshoi (or Great) Altai range. Fullarton's 'Gazetteer of the World,' vol. 1, 1856, p. 186, remarks: "In fact, the name Altai should be restricted to the great range which, running from south-west to north-east, separates Zungaria from Mongolia."

Nucleus. Hence the typical Altai Mountains, which Kropotkin calls "the Altaids proper," are not Altaids in Suess's terminology.

(*b*) *The Western Altaids.*—Asia, south of this Altaid Sub-nucleus, according to Suess, is traversed by a succession of Altaid waves, which include the Tian-shan, Bei-shan, the Lun-shan, Nun-shan, and central Kuen-lun mountains. To the west of the Tian-shan the Altaids are continued, according to Suess, along two lines. The more southern line runs from the Pamir through the Hindu Kush,* and the Caucasus; it crosses southern Russia, and includes the hills of southern Germany, Belgium, central and north-western France, north-eastern and eastern Spain, and Portugal. The more northerly line passes through the mountains on each side of Lake Balkash, and through the Kirghiz steppes toward the Urals.†

(*c*) *The Posthumous Altaids.*—In northern Africa some of the mountains of the north-western Sahara and part of the High Atlas are interpreted by Suess as Altaids; but between them and southern France and Germany, all the land, except parts of Corsica and Sardinia and the western part of the Spanish peninsula, belongs to Suess's class of Posthumous Altaids, of which the most important are the Alpine mountains, or Alpids. The Altaids of Europe Suess classified into two groups, the Altaids proper, due to Upper Carboniferous folding, and the Posthumous Altaids, or Alpids, due to Kainozoic folding.

Suess attributed the Alps, Apennines, Carpathians, Balkans, the mountains of eastern Spain, and the Atlas, as all formed in areas which had sunk inside the Altaid zone. These sunken areas lay in an Altaid framework, and were then buckled into mountain chains by its contraction. According to Suess, therefore, the mountains of the Alpine systems were due to the older mountain framework acting as a great pressure-frame, and not to a meridional shrinkage of the whole Eurasian mass.

(*d*) *The Eastern Altaids.*—The Altaids expand in width eastward. The Kuen-lun chains pass north-eastward through the Ala-shan and In-shan into northern China. In central China the Altaids are represented by the Tsin-ling-shan, which continue easterly from the Kuen-luns and end along a line that Richthofen regarded as the continuation of the Khingan fracture. Further to the south-east the Altaids are represented by mountain ranges which trend south-eastward through south-western China, Siam, and Annam, and by various mountain chains in the

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* The Elburz mountains, originally included on this line, were transferred by Suess ('Antlitz,' 1901, vol. 3, part 1, p. 365) to the southern marginal chains, as part of the arc of Iran.

† As to the true position of the Urals, Suess recognizes some doubt. He noticed various features which suggest that they are the continuation of the Tian-shan system, but he finally adopted the conclusion that they are abnormal folds on the primitive nucleus. They are not strictly marginal, as the Russian platform of western Russia is part of the primitive nucleus.

Philippines, Borneo, and other western islands of the Malay archipelago; and from these the Altaids extend as far east as Timor.

The northern margin of the north-eastern Altaids is not clearly separated from the Primitive Nucleus, which in Transbaikalia includes a pre-Altaid tableland of lower Palæozoic rocks. This Palæozoic border of the Primitive Nucleus merges with the Altaids in the Ala-shan north-west of the Ordos, and in the adjacent parts of western China.

3. *The Marginal Arcs of Eurasia.*—According to Suess the third essential element in the mountains of Asia consists of the marginal arcs. They include a series along the eastern coast, such as the mountains of Japan, and the southern arcs, of which the most important is that of the Himalaya. The southern series is represented further east by the western mountains of Burma, and the disrupted mountain chain that once passed to the west and south of Sumatra. To the west the marginal arcs are represented by the arc of Iran in Baluchistan and Persia. Further west the marginal arcs are continued by the Pontic-Dinaric arc of Asia Minor, of the western Balkan peninsula, Cyprus, Crete, and the Gargano and Otranto promontories of eastern Italy. This arc is separated at its western end from the Alps by the Carnic mountains, which, according to Suess, are independent both of the Alps and of the Dinarics, and are older than both of them.*

III. Discussion of the Classification.

1. *The Value of the Foundation in Mountain Classification.*—Suess's classification has several recommendations. It separates the Himalayan line from the northern highlands, such as the Sayans, and from the north-eastern chains such as the Yablonoi and Stanovoi mountains; and so different are they in structure and geographical character that this separation seems thoroughly justified.

It should, however, be remembered that the formation of the outer face of some of the Asiatic highlands was at approximately the same date as the elevation of the southern fold mountains of Asia, and this agreement in age should not be overlooked owing to their structural differences. The age factor in mountains is of great importance, as mountains are rapidly lowered by denudation. The probabilities are great that all mountains which rise 15,000 feet above sea-level, or many thousands of feet above the adjacent country, are of comparatively recent geological age. For if such high lands are extensive in area they are gradually lowered by isostasy, and if they are narrow mountain chains they are cut down by denudation.

A geographical classification of mountains should unite those in which

* Suess's arguments for the separation of the Alps from the Dinarids are that the latter are marginal, Asiatic in character, and due to southward thrusts.

the relief is similar * owing to their being of approximately the same age and to their having similar structure. It should discriminate between fold mountains of different ages, between long plateau scarps and chains of fold mountains, and between fold mountains, dissected plateaus, and wide areas of rolling downs.

The essential geographical feature in a mountain system is its existing relief and not the early history of its materials. A building may be Gothic in style whether it be built of stone originally hewn for it or for some pre-Gothic edifice.

The first serious objection to Suess's classification rests on the excessive importance it attaches to early earth-movements which affected the foundations of the mountain areas. On this ground it unites such areas as Brittany and the Caucasus, which have different geographical characters, while it separates areas which are of similar geographical characters, such as the Pyrenees and the Caucasus. The foundations of most great modern mountain systems contain faults and folds due to very ancient earth-movements. The Alps, for example, contain traces of pre-Kainozoic disturbances, and though these may modify the course of the later foldings, they do not affect them fundamentally, and the earlier movements have only a minor influence upon the present topography. The old movements are of great importance in the geological history of the Alps, but they have only a secondary influence on their geography.

On the same ground Suess separated England south of the Thames and Severn, which he included in the Asiatic edifice, from the rest of Britain. This separation is based upon the old Caledonian movements which affected northern Britain, but have left no direct effect on the present topography. In analogy with the view that the Alps are posthumous Altaids, the British geographical features, which agree in direction with the Caledonian lines, might be regarded as posthumous Caledonids; but this course seems undesirable since, although some of the newer movements were parallel to the older lines, the two sets were due to different causes.

Suess's classification does not serve ordinary geographical purposes, for it links together elements which are different in their topography and in their geographical influences, political, climatic, and biological; while it separates elements which have similar geographical influence. A classification of mountains which represents the Alps as closer akin to the hills of Brittany than to the Himalaya, and makes the Dinaric mountains and the hills of Crete the European equivalents of the Himalaya, is obviously not intended as a guide in the comparison of existing earth forms.

The older scheme seems to me essentially correct in its reference of the

* This similarity must be interpreted with allowance for the strength of the rocks, their unequal resistance to folding and denudation, local variations in the intensity of folding, and the nature of the denuding agencies. Hence arise such differences in relief as those between the Pyrenees and Apennines, between the Alps and Atlas, and even between neighbouring sections of the same mountain chain.

Alps, Dinaric mountains,* and Himalaya, to the same class. The Alps, the Pyrenees, the Carpathians, the Dinaric arc, the southern mountains of Asia Minor, the Caucasus, the Himalaya, the western mountains of Burma, and some of the southern chains of the Malay archipelago, have several important features in common. They were all elevated in the same epoch of crustal folding which culminated in the Middle Kainozoic. They were all due to great crustal compression, and were therefore all formed by close folding combined with overthrusting.

The direction from which the thrusts came at any particular locality depended on local conditions, and is of secondary taxonomic importance; so also is the fact whether the newer and older foldings happened to coincide as in the Pyrenees or the Caucasus, or whether they were transverse as in the Carpathians. According to this view, Suess's Altaids belong to two distinct groups. Some, such as the Caucasus, belong to the Alpine-Himalayan system, for though they are on the site of Altaid mountains, their geographical importance is due to the Kainozoic earth-movements. Others, such as the Hercynian mountains of Europe, have not been renewed by recent folding; and it seems to me that Suess's class of Altaid mountains should be limited to those in which the present topography is not due to Kainozoic earth-movements.

2. *The Correlation of Europe and Asia.*—Objection may be taken to Suess's correlation of the geographical elements in Asia and Europe, and to his view that the Himalaya correspond in Europe with the Dinaric mountains and not with the Alps.

Suess's correlation of the two geographical units in the eastern and western sections of the Old World may be summarized in the following table:—

Element.	In Europe and Africa.	In Asia.
Northern highlands ...	Primitive nucleus	Primitive nucleus
Altaid zone	Mountains of Brittany, central France, southern Germany, etc.	Caucasus, Tian-shan, Kuen-lun, etc.
Basins of Altaid zone ...	Mediterranean	Mongolian Lake valley and Pre-Tian-shan rift-valley
Posthumous Altaids ...	Alps, Atlas	None
Southern marginal arcs ...	Dinaric arc	Himalaya
Depression south of marginal arcs	Valley of Shotts, Levant	Indo-Gangetic plain
Southern plateau	African plateau	Peninsula of India

The classification is open to several doubts and drawbacks. It is based on the view that the essential difference between the structures of Europe and of Asia is that the foundered areas in Europe are peripheral, and in

* The Dinaric Alps belong to a different subclass from the Alps, but to the same subclass as the Apennines and Tauric mountains.

Asia they are central, such as the amphitheatre of Irkutsk. But the whole of southern and eastern Asia is fringed by seas due to the foundering of the former margins of the continent, such as the Sea of Okhotsk, the Japanese, Yellow, and China Seas, the Bay of Bengal, the Arabian Sea, Persian Gulf, and Red Sea. Hence Asia has also been affected by marginal collapse, though Europe is not without central subsidences, such as the plain of Hungary; while as the western Mediterranean and the Black Sea are inter-Altaid, they may be regarded as internal.

The second distinction is that from the Sea of Azov to Texas all the western Altaids are backfolded, so that most of the mountains are overfolded from south to north; whereas in Asia the great later folding, which was contemporary with the posthumous folding of Europe, was from the Continent outward, being eastward in Japan, southward in the Himalaya, and south-westward in southern Persia. This reversal of direction between the later movements of Europe and Asia appears capable of simple explanation; for in Asia the mountains were thrust outward from the great plateau towards the nearest ocean basins, whereas in Europe the present basins were not formed until after the mountain folding; and they were, therefore, not available for the relief of the compressed crust.

3. *The Relations of the Mountains of North-Eastern Siberia.*—Suess's separation of the Himalaya from the mountains of north-eastern Asia appears to be valid. Such mountains as the Yablonoi, Stanovoi, and the Khingan mountains have none of the features of the Alpine chains. Suess even proposed that the word Stanovoi should be omitted from the maps, since this so-called chain is only a plateau or height of land, of which the steep face towards the Pacific is due to the foundering of the Pacific floor. The Yablonoi mountains are a better-marked range, because they form a narrow band of high land between two great valleys. The work of Kropotkin threw much light on the essential structure of this district, and prepared the way for Obruchev's conclusion that these mountains are only long horsts left between two rift-valleys. Cherski and Kropotkin considered that these valleys had been made by denudation, but Obruchev* rejected this conclusion, and attributed their formation and the basin of Lake Baikal to "disjunctive dislocations," and Suess has adopted Obruchev's conclusions. The views of this country from the Siberian railway show the characteristic features of a series of parallel block-mountains and rift-valleys, so that the tectonic origin of these valleys seems to me correct. The Khingan mountains are also due to faulting, for they are the eastern dissected fault-scarp of one of the plateaus in the Primitive Nucleus,† and they are described by Obruchev

* The most accessible statement of Obruchev's views are in his paper "Orographik und Tektonik Transbaikaliens, auf Grund neuester russischer, von 1895 bis 1898, ausgeführter Forschungen." '7th Inter. Geogr. Kongress,' vol. 2, 1899, pp. 192–206.

† That the Primitive Nucleus does not extend as far as the Khingans is suggested by the title of the chapter in the Oxford edition, "Peripheral Formations to the East of the Vertex." The title in the original says, "im Osten des Scheitels."

as the tectonic boundary between Transbaikalia and Manchuria. These two regions appear to have no Alpine chains, and the eastward continuation of the Alpine-Himalayan line passes from the Himalaya, through Burmah, to the Malay archipelago.

In some respects, therefore, Suess's explanation seems to me a valuable advance; but in others the traditional classification seems of greater geographical usefulness. The partial rejection of Suess's classification does not, however, invalidate his main principles of mountain distribution. The chief cause of mountain formation appears to be the slow contraction of the Earth, which, though taking place continuously, results in the formation of mountain chains at special epochs of crustal disturbance. These disturbances produce bands of intense folding and overthrusting; and these bands of crowded folds have become more and more restricted in width and distribution, as the Earth grew older and its crust thicker. The direction of these folded bands has been greatly influenced by rigid massive crust blocks.* The folds have been sometimes flung against these inflexible forelands and become asymmetric and broken, like waves of the sea which beat against a projecting headland. But further from the forelands the folds are symmetric and shallow, like the swell on the open sea.

The mountain folding is followed by the collapse of great crust-blocks during the reaction from compression. The subsidences around the continents have formed the great marginal deeps and sea basins. In the interior they have caused broad sunklands and long rift-valleys. These foundered areas may break across the mountains; but their usual position is behind the fold mountain chains which, owing to the relief of pressure, often undergo secondary backfolding towards the sunken areas.

Intense folding is a deep-seated process, and may be accompanied by a still deeper subcrustal flow; the direction of the main movement, during a period of mountain formation, may therefore not be correctly indicated by the superficial disturbances. Owing to the action of subcrustal flow, as Bailey Willis has pointed out, the pressure which formed the Asiatic mountains may have acted in the opposite direction to that accepted by Suess. Nevertheless his doctrines of mountain distribution appear to remain valid, and the third volume of his great work will doubtless take its place as one of the primary documents on the geography of Asia and the classification of its mountains.

Dr. J. W. Evans (before the paper): I have been unexpectedly asked to take the chair on the occasion of Prof. Gregory's lecture on the Classification of the Mountain Systems of Eurasia by Prof. Suess. I feel it an honour to do so,

* De Launay in his 'La Géologie et les Richesses Minérales de l'Asie' (816 pp., 10 pls.), 1911, lays especial stress on the influence of the older crust-blocks on the trend of the mountain lines.

because the occasion is an important one. It is the first time since the death of that great geologist that we have an exposition of his views in this country, and I am sure there is no one so well qualified to give it as Prof. Gregory. For some twenty years past Prof. Gregory has been, so to speak, the apostle of Suess's views in this country; in fact, a great many of us owe our knowledge of them to him. I certainly do myself, and I look forward with great interest to hearing them put before us to-day.

Prof. HERBERTSON (after the paper): It has been a great pleasure to listen to Prof. Gregory's admirable synopsis of Suess's views on the structure of Eurasia. Those of us who have attempted to make such an abstract for ourselves know how much time and trouble it takes to disentangle the main facts and conclusions from 'The Face of the Earth' in spite of its occasional summaries. We admire and thank Prof. Gregory for his characteristically lucid account, which will be read with gratitude by many a student of geography when it appears in the *Geographical Journal*.

My first acquaintance with Suess's generalizations was gained from Prof. Steinmann's lectures some twenty years ago; and I remember, when writing the general chapter on Asia for Dr. Mill's 'International Geography' a little later, with what delight I read Suess's recently published paper on the "Asymmetry of the Northern Hemisphere," which contains many of the ideas developed more fully in his larger book. No one can study such morphological works without gaining enormously, not merely a knowledge of structural processes and results, but an understanding of topography which cannot be obtained in any other way. The idea of the building up of the northern land masses round centres or nuclei of early consolidation by successive additions outwards of belts, first sufficiently plastic to be folded and then slowly becoming rigid, while further out a new pliable belt appeared, is not merely fascinating, but invaluable for the study of the topography as well as of the morphology of the continents. Each morphological area has its own set of topographical types, and it is an immense simplification to the geographer to know that only certain types of surface features can be found in each successive morphological belt. The dissected Trans-Baikalian highland, an old mountain system base-levelled, then elevated as a mass or block in which great valleys have been eroded, is akin to the Black Forest and other highlands of Central Europe, and not to the more recently folded systems such as the Alps. I have been accustomed for some years to call such base-levelled old mountain systems which have been raised and carved into valleys and ridges by erosion, highlands, and to call mountains the belts of more recently folded strata. Most of the highland areas are under 6000 feet, while much of the land over 6000 feet is part of the great mountain systems. Mountainous structure of course occurs below 6000 feet, but the topography of the two types, mountain and highland, is usually very different, and hence it is important for the geographer to make the distinction.

So I agree with Prof. Gregory that the southern mountain system of Eurasia, from the Pyrenees and Alps to the Himalaya and the mountains of western Burma, should be grouped together and distinguished from such highlands as those of Britanny. I also sympathize with his objection to the translation of *Scheitel* by "vertex." The German term is not a happily chosen one, and nucleus certainly represents Suess's idea more truly than the more literally accurate vertex.

In considering Suess's work we must remember what he was attempting. He was trying to sketch the chief phases of the Earth's structural history, and his divisions are based on structural and historical considerations. The value of this work for geographers is found in our being able to associate his divisions with certain types of surface forms; but we must not expect that his groupings and those of the geographers will agree in all respects. Such a paper as that by Prince

Kropotkin on the "Orography of Asia," published in the *Journal* (vol. 23, pp. 176 and 331), is perhaps more useful to most students of geography. But those who have taken the trouble to study Suess, and to compare the morphology and the topography of Eurasia, will never regret it.

Having had so much from Prof. Gregory we naturally ask for more. I should be glad if he would give us, say at another afternoon meeting, his own views on the structure and topography of Eurasia, and in doing so to review the papers on the structure of Eastern Asia which were among the latest important publications of the late Baron von Richthofen, the views expressed by Prof. de Launay in his works, as well as other recent contributions to this very complex subject.

Prof. LYDE: I only speak under protest and by special request, and I protest from two points of view. One is, the paper deals with a subject I know very little about, and the other is that, so far as Prof. Herbertson has referred to some points, I am myself his pupil in all those matters. One or two things I might suggest, but only from the narrow point of view of economic geography. Prof. Gregory did refer to the main point; he says, "In some respects, therefore, Suess's explanation seems to me to be a valuable advance, but in others the traditional classification seems of greater geographical usefulness." That seems to me to be exactly the point. For geographical purposes, geological classification does not seem to be what we need. Then he says, "The essential geographical feature in a mountain system is its existing relief, and not the early history of its materials." From a teaching point of view, certainly it seems to me absurd that one should dissociate such absolutely similar sierra types as the Pyrenees and the Caucasus, and associate either with an area like Brittany. Again he says, "A geographical classification of mountains should unite those in which the relief is similar *owing to* their being of approximately the same age and to their having similar structure." I do not quite go with that "owing to." No doubt it is only when you get areas of the same structure, under the influence of similar processes, and those processes carried to a similar stage, that you would get precisely similar results. From my own point of view, I would prefer that the human note should be emphasized, even in the structure of mountains. Prof. Gregory says, "Hence the northern border ranges like the southern chains have been described as Alpine. If the term Alp be used in its original sense for a mountain pasture, these mountains may be justly called Alpine, but they are not Alpine in internal structure." If they are called Alpine from the point of view of pasture, I would suggest the word should be written with a small "a." But in economic geography I cannot see that internal structure is the vital consideration. I would practically decide whether a range is Alpine by the test of whether we can or cannot tunnel it. It does not matter to me whether the Alleghany scarp has or has not been folded along its upper edge in comparatively recent years; that is of no vital importance. The essential thing is that the Pennsylvania and Ohio railway has to climb up a permanent 2000-feet level. In the first page of the paper he refers to the current classification. I would suggest that this is not rigidly current in economic geography, at all events in teaching it. I know a good many economic geographers who would not even accept it as it stands, because the human note is the essential thing, even about the mountains; and it is expressed in such terms as transport, economic products. One would ask whether such and such a formation is granite, or—if it is sedimentary—whether it is of an age that would give it the possibility of coal. With regard to transport, one would ask, Is it an Alpine area with typical alternation of peak and pass, or a sierra with typically even skyline? In the one case, one wants, no doubt, the time relation of the particular area to its neighbour, *e.g.* the metal-bearing scarp to its coal-bearing flank; in the other case, the space

relation, *e.g.* the level and gradient. But I would prefer a "current" classification into highland areas and highland lines. One may talk of a peneplain or block as being old, and of the line as being young folded mountain, but the essential point is whether the mountain is of the Alpine or the sierra type. The only point I want to press is that in all these classifications, if you want to be useful geographically, you must emphasize the human note, partially at all events.

Dr. EVANS: We have heard a great deal of mountain ranges in various parts of Asia of which we have hardly known more than the names before. When I first studied geography we used to take a relief map of Asia, more or less incorrect, of course, and follow the lines of mountains and form them into groups, and show how they were collected together in certain points in knots, and further on expanded like an ample sleeve, so as to form a series of radiating mountain masses, and then we were satisfied we had made a scientific classification. The man of science, with all deference to Prof. Lyde, believes that the only classification is that which is genetic, which explains how the mountains came to take their present form, and I am convinced that even if our interests are mainly economic, we shall understand and remember the chief features of the mountains and their relation to human development and industry all the better if we understand their structure and their history. This history is in the main the history of the building of the continents. As a general rule, the oldest part of a continent consists of ancient rocks which have been folded into a solid mass at a remote period. They constitute what Suess calls the "Scheitel," and Prof. Gregory the nucleus, though I would suggest that a more suitable word would be the core. This core has, by the operation of forces of denudation, been long since levelled to a plain or peneplane, and as the result of its original compression it has been converted into such a solid block that it has in most cases resisted all further change, except, of course, a certain amount of faulting, of which Prof. Gregory has given us some valuable studies. Such a block has formed the centre on which the building up of the continent has taken place. At different geological epochs, as a result of the compression of the Earth's surface, the softer rocks round the core have been thrown into folds, giving rise to mountains of the Alpine type. In course of time, these too, in their turn, have been ground down to form an extension of the central block. The latest of these folds have given rise to the present mountains of the Alpine type, which form arcs on the margin of the continent, and they in turn are destined to go through the same process of planation.

If subsequent crushing of the older harder rocks occurs, the mountain masses which are formed must differ in character from those which result from folding of later, comparatively soft strata. This is illustrated in the south-west of England. There the great movements of Permian times folded the softer Carboniferous rocks into small undulations, often of a diagrammatic character, while the Devonian rocks, which had by that time become thoroughly consolidated, were crushed and overthrust in a totally different manner; and in the early part of the Secondary Period, when the mountains resulting from the earth-movements still existed, there must have been fundamental differences in the external characters of the hills of the Carboniferous and Devonian districts. Everywhere we have not only got to take into consideration the date of the folding, which is of great importance, because it is only those which are of late date which are represented by mountains of the Alpine type, but also the character of the rocks which were folded.

It is not too much to say that it is mainly to Prof. Suess that we owe the great progress which has taken place in the study of mountain building in the last quarter of a century; but at the same time I agree with Prof. Gregory that his

classification is open to criticism. A grouping which separates the Alps and the Himalaya, and places mountains like the Caucasus in the same category as the hills of Britanny, can only be regarded as hopelessly misleading. I am sure we are very much indebted to Prof. Gregory for bringing the subject before us, and I hope that some of those who have listened to his interesting paper have registered a vow that they will read the whole of the book that forms its subject, the third volume of that great monumental work of Suess, 'Der Antlitz der Erde.'

Prof. GREGORY: I have to thank all the speakers for their kind remarks, and am glad to hear that Prof. Herbertson also prefers nucleus to vertex, and of his use of the term "highlands." In regard to the question whether nucleus or core is the better, I long hesitated between those two terms, and talked it over with others, and though from the literary point of view I prefer core, nucleus on the whole seemed rather better. If everybody agreed to use core, I would certainly adopt it. The main point of this afternoon's discussion has been as to the basis of the ordinary classification of mountains for geographical purposes. I think any such classification must be essentially a compromise; and when I find Dr. Evans saying it must be genetic, while Prof. Lyde declines to accept genesis at all, I hope I have suggested a satisfactory compromise. But even from the point of view of the economic geologist it does not seem quite safe to disregard structure. One railway contractor went into the bankruptcy court because he contracted for a railway tunnel on a wrong idea of the structure of the mountain. The fact that a mountain range is tunnelable does not make it necessarily Alpine. Some mountain blocks are so long and narrow that they can be tunnelled, yet they are simply blocks left by faulting. I think it is going too far to disregard structure altogether, and I think the term Alpine should be limited to mountains of which the formation has been largely due to folding.

THE LOST FORESTS OF AFRICA.

By Captain C. H. STIGAND.

WHEREVER the white man, in his first explorations in Africa, has met with agricultural tribes living in juxtaposition to forest areas he has found those tribes busily destroying the great timber trees with fire and axe, and extending their cultivation at the expense of the forest area. The native has learnt that the fertile soil, freshly cleared of forest, yields him a most productive harvest for his crops. As he is, as a rule, quite innocent of the arts of scientific agriculture and manuring, this freshly cleared land begins to get poor after a few years of cultivation. He then proceeds to clear more forest, rather than make use of fallow land already cleared. As long as there is any forest to attack he continues to devastate it either until it is finished, or, in recent years, until the white man steps in to protect what remains.

Stanley, in his journey from the Aruwimi to Lake Albert, speaks of the enormous clearings he encountered in the great forest, round native villages. Even before coming to the cultivated areas it was often necessary to pass through miles of fallen trees, left to dry until ready for burning. In British East Africa the natives have continued

encroaching on the forests of the escarpments, Kenya and elsewhere, until stopped. If the white man had deferred his occupation of Africa another hundred years the chances are that, in the east at any rate, he would have found no forests. It would then have been difficult for him to believe that some of the expanses of prairie and bush he met with had once been covered by fine trees.

The usual native method of clearing is to cut down smaller trees and undergrowth with the axe. These are left till dry, and then piled round the big trees and fired. Finally the big trees fall and are left till dry enough to burn. It might be thought that if forests were being destroyed in some parts they were growing up as fast in other places, but this is not so, at least in the parts known to me, East and Central Africa.

First let me explain the kind of forest of which I am speaking. It is not the country of scrub and bush, interspersed with long grass and an occasional big tree, or the bush of gnarled and stunted thorn trees, or else the great woods of anæmic and thin trees, struggling upwards as if for air, but giving no shade. All these types of country are occasionally spoken of as "forest," but I speak of the great forests of timber trees, festooned with lianas and vines, to the floor of which, deep in damp mould, rotting leaves and decayed and fallen trees, the sun scarcely reaches. An area of such a forest, once it is cut down, does not grow up again. Its edges may encroach imperceptibly on the surrounding country, where it is not attacked. For instance, the last tree may grow and spread its branches further over the outside land, dropping its leaves and dead twigs over the earth until enough humus has been formed to encourage a young tree to take root, and the latter may in twenty or thirty years have grown up sufficiently to have reclaimed another few yards of the unforested area. This may happen, but such slow progress can do little to counteract the destruction of the native clearings, progressing at the rate of perhaps several hundred yards a year.

The soil of the cleared area is subjected alternately to the fierce rays of the sun, which dry up the moisture, and the tropical downpour which washes all the good out of it and into the nearest watercourse. The termite establishes himself and eats up any dry stumps and woody substance to be found. After a few years of cultivation the native abandons the spot for fresh ground, and it becomes covered with rank weeds or long grass. This is subject to the yearly bush fires, which further dry up the soil. Perhaps after a time gnarled and stunted bush and scrub is able to make headway against the yearly scorching, but the magnificent timber trees are gone for ever.

It stands to reason, then, that the forested areas must formerly have been greater than they are now; how much greater depends on how long the native has been at work on them. Presumably the native has been clearing forest, more or less, ever since he learnt the art of agriculture, though at first he may not have appreciated the full value

of virgin soil. It is also possible that the continent may have been more sparsely populated at that time, but not of necessity, as slave raiding, intertribal wars, mahdism and sickness have, to our certain knowledge, considerably reduced the population of large areas.

I am unaware if there is any definite evidence available as to the date the central African acquired his agricultural habits, but we can certainly say that he was not cultivating many of his present products prior to the sixteenth century. For instance, maize is supposed to have been unknown in the old world until Columbus brought it to Spain in 1520. It now forms the staple food of many tribes, whilst bananas and manioc (or cassava), the principal diet of others, were originally discovered in America. These three, together with tobacco,* were probably introduced by the Portuguese to their African settlements on the coast, and from thence spread inland. The sweet potato and the sorghum (or jowari), the latter perhaps the most widely cultivated crop in Africa, are supposed to have come from India, and probably were of earlier introduction; possibly the sorghum may have reached certain parts of northern Africa long before. However, prior to the arrival of the American crops it is probable that the central African was more of a hunter, and less of a cultivator, than he is now.

Even if we assume that he has only been an active cultivator from the probable date of maize and manioc reaching him—say, three hundred years—and taking into consideration his wasteful methods, this time would be sufficient for a populous tribe to eat 20 to 40 miles into a forest. So a forest belt of from 40 to 80 miles in width might have been made to disappear if there were a tribe on each side of it. Sorghum-planting natives working southwards from the north might have had time to make much greater inroads.

Let us now try to obtain evidence of where forests have actually extended to, and see how far the result agrees with the above. First, however, it would be as well to define roughly the existing forest areas. The tropical forests of Africa, like those of South America, follow the line of the equator. Starting from the east we have, on the coast, a small forested area to the north of Mombasa. Travelling westwards we get a patch on the slopes of Mount Kilimanjaro and another round Mount Kenya. Next a strip on the Aberdare range, and strips west of this on the escarpments either side of the Rift valley; that on the west side being by far the longest and broadest. In Uganda we get the Mabera forest, and to the west the Budonga forest, and again, south of this, forest about Ruwenzori. Crossing Lake Albert, after a bare strip on its western shore, we get the great Ituri and Congo forests, prolonged westwards and northwards by the forested region of the French Congo, Cameroons, Southern Nigeria, and the west coast.

* Certainly the lanceolate-leaved tobacco of the Virginian type. There is also a tobacco of a short and broad-leaved type.

We thus see that, whereas the east coast is almost without forest, the further west one goes the greater and more continuous the forests. The whole is shaped, more or less, like a triangle with the apex on the east coast and the base on the west.

The forests of the west coast are mostly in low country; those on the east are mostly on the slopes of high mountains. The latter may be attributed to the greater moisture of the highlands; or it may be that the slopes of mountains would be the last places which the natives would choose to clear for cultivation.

Mount Kenya is surrounded by a belt of forest, and, about 40 miles to the west, the slopes of the Aberdares are similarly clothed. Between the two is the thickly populated country of the Kikuyu, a land of steep and bare red hills and treeless ravines. At first sight it is difficult to believe that this country has ever been under forest. The following considerations, however, seem to prove that it was so:—

(1) On either side the natives can be found encroaching on the forested slopes, and there the conversion of the rich forest into bare red hills can be seen in all its stages;

(2) Streams from the mountains pass through the populated country in treeless valleys. Where they emerge from the inhabited country into the uninhabited plains, they may be found with their banks lined with big forest trees;

(3) It is the custom of the people to keep certain spots, generally on hilltops, as sacred groves, no man daring to cut down or disfigure any vegetation growing on such a spot. Owing to this, one finds dotted about in this treeless country little groups of trees, sometimes bearing lianas, characteristic of forest vegetation.

Seeing these miniature islands of forest, left in an ocean of cultivation, it is not difficult to picture a forest formerly stretching from Kenya, on the one side, to the Aberdares on the other. The Kikuyu are an immensely prolific people; they are known to have increased enormously of late, and are believed to be fairly recent arrivals in this locality.

There is, moreover, a further proof of the recent destruction of forest in this part. Just about midway between the two forests is one of these little groves on a knoll, and this grove is, or was, inhabited by a family of a dozen or more colobus monkeys. Now, the colobus is perhaps the most purely arboreal monkey there is; he does not come to the ground. In his natural state he lives flying from tree to tree, and in this manner he covers considerable distances. In the forest their peculiar croaks can be heard coming nearer and nearer, passing overhead and receding again as they travel. It is inconceivable that this group of colobi could have come overland from the nearest forest, 20 miles distant, or that they inhabit this very restricted area from choice. I presume that native clearings formerly left a considerable patch of forest, severed from those

on each side, and that this area was reduced year by year, till at last these colobi had only this sacred grove left to them.

Similarly, it may be assumed that all forest patches, where colobi are found, were at one time joined up together. For instance, they are found in the Agurr mountains east of Nimule, a locality surrounded by more or less sterile country. They have, however, there a certain amount of area to inhabit, and can follow the tree-lined streams for considerable distances. The period at which this country was connected with other forests may have been indefinitely long ago. It is only when the colobus' quarters are as restricted as those of the sacred hill, that it is impossible to believe that they have long been confined to such a small area.

A typical forest denizen is the chimpanzee. The farthest east this animal occurs is in the Budonga forest of Uganda. He is common in the Ituri forest. The farthest north I know of his presence is in the gallery streams 20 or 30 miles north-west of Mount Wati. I believe further west he is found still more northwards. Such places are far removed from his typical haunts. There are here no extended areas of forest, but only the indications of the remains of forest in small patches and the tree-lined "gallery" streams. I cannot help thinking that at not so distant a date these parts were linked up with the Ituri and Congo forests. The green parrot, in its distribution, closely follows the chimpanzee. I do not know of its occurrence so far north as the latter. The deduction I would make is that the parrot, on finding the forests receding southwards, retired with them, whereas the chimpanzee, on finding himself isolated, was unable to do so.

The okapi and the pigmy are also typical forest dwellers. They were known to the ancient Egyptians, as is proved by a drawing of the former and a mummy of the latter. There is a record of an expedition being sent to fetch some pigmies to Egypt about 3400 B.C. Now the earliest mention of anywhere south of Egypt is about 4000 B.C. At the date of the above expedition the negroid peoples extended as far north as Assuan. The ancient Egyptian rulers appear never to have included in their dominions country any further south than about the fourth cataract, or the Atbara, and that only at rather a later date. When this expedition left, Assuan was the southernmost limit of their rule.

The nearest point to Egypt that the okapi and pigmy are at present found is the Ituri forest. To reach that locality the expedition would have had to negotiate the cataracts between Halfa and Khartum, to have got their ships on the upper reach. They would then have had to proceed about one thousand miles up the Nile, passing through the sudd region, until they reached the limit of navigation, and then left their boats and proceeded some hundreds of miles over land. Considering how little the Egyptians ever extended their rule into the savage countries to the south, it is difficult to believe that they had an intimate knowledge of a country so far distant. It is easier to believe that the okapi and the pigmy were

found in those days nearer to Egypt, possibly in the Bahr el Ghazal, and hence that the forested area reached to that locality.

It is said that the ancient Nile gauges on the Halfa reach show that the river at high Nile was then much higher than it is now by some 26 feet. In the course of time it might be expected that the bed of the river has worn to a lower level, but not so rapidly as this. A large forested region on the upper Nile would have meant more rainfall and consequently a higher Nile.

Above is collected a certain amount of evidence, though very meagre, as to the extent of former forests. Before trying to materialize it let us consider—

1. The valley of the Nile as compared to the basin of the Congo.

2. The desert regions of the world as compared with the regions of tropical vegetation.

1. The valley of the Nile is, generally speaking, dry and lacking in vegetation, whereas the Congo basin is moist, well watered, and thickly clothed. On the Gado-Welle frontier the change is very marked. On the Nile side of the frontier the country is less fertile; it bears chiefly thorn and stunted trees, and the watercourses are poorly clothed. Directly the frontier is crossed—and one meets streams which find their way ultimately into the Congo—one finds them lined with a luxuriant growth; many of them form what the old travellers called gallery streams, viz. streams flowing in a narrow belt of forest. This difference in vegetation may be partly due to the steeper fall of the ground on the Nile side, for whereas the country drops 1000 feet or so to the Nile in 100 miles on the one side, it drops only a few hundred feet in a similar distance on the other side. Yet to the east of the Nile at this part, where the country is more or less flat, its sterile nature is equally manifest. The whole valley of the Nile gives one the same impression, whereas the Congo basin gives one the idea of moisture and luxuriant growth. However, the forest belts on the banks of the Alla and the Azuka rivers, in Uganda, south of Lake Albert, show that a forest growth is not incompatible with the upper parts of the Nile. The deduction I would make from this is that the upper parts of the Nile were probably once forested to a certain extent. The loss of a forest area, together with the lesser rainfall, has imposed on the upper parts a sterility natural to somewhat lower stretches. The basin of the Congo, with its greater rainfall, is, *par excellence*, the region of forests.

2. The desert regions of the world are so uniformly in one line of latitude throughout that the chances are that they are caused by considerations quite apart from human agency. It would thus be futile to expect to find traces of forest in a well-defined desert area. Similarly the line of tropical vegetation on the equator is so consistent in all parts of the world, that where it is absent one may be led to suppose that there is a certain amount of probability that this was not always the case.

Desert regions are found, very approximately, between the latitudes of 15° and 40° both north and south of the equator. In the northern hemisphere there are the deserts of Gobi, Rajputana, Arabia, Sahara, and the salt lakes of Utah all, more or less, on the same line. In the southern hemisphere there is less land, but where continents exist, on the corresponding lines of latitude, we have the desert regions of Australia, the Kalahari, and the shingle desert of Patagonia. Practically all these deserts are more pronounced on the west sides of their continents than on the east, and many of them are protected from the open sea on the east side by a strip of more fertile land. For instance, we have the more fertile parts of China interposed between the Mongolian deserts and the sea. The deserts of Australia, the Kalahari, and of North America are all to the west of their continents, with more fertile country to the east. If one can make any deduction from this it is that fertile areas, and hence old forest areas, are more likely to have encroached on desert areas to the east than they are to the west.

An area of luxuriant tropical vegetation clings closely to the equator throughout the world, viz. New Guinea, the Congo, and the Amazon basins. In East Africa, on the equator line, this luxuriant belt is more or less missing, or only appears in patches. The inference is that it was not always so. South of this in Portuguese East Africa, Nyasaland and north-eastern Rhodesia there seems to be no evidence of former forest, either from the presence of forest trees or of forest denizens. They are lands of thin struggling trees, with only an occasionally big tree in a river-bed. Indeed, these are countries outside the tropical belt, and further west we get the desert country of German South-West Africa. The presence of the Sassaby, a denizen of the open plains, near Lake Bangweulo, seems to point to the country south of that lake being formerly more open than it is now. For these Sassaby are cut off from the main habitat of the species to the south, by several hundred miles of bush country. Presumably, at some time or other, that country must have been more open to allow them to reach that spot.

The final deductions I would make from the evidence collected above is that about three hundred years ago, when the Central African first began cultivating the plants introduced by the Portuguese, there was an almost continuous forest belt across Africa. Leaving the coast north of Mombasa, it may or may not have reached the Kenya forest. Anyhow, the Kenya forests extended then southwards of their present limits. This mass joined the Aberdares by a broad strip of forest 40 to 80 miles broad, and continued unbroken until the eastern edge of the Rift valley was reached. Here it may have crossed the valley about Nakuru, or only occurred in patches, as it does now in a few places. On the west side of the valley there was a big stretch of forest extending as far north as Elgeyu, and this mass proceeded west almost unbroken as far as Muhoroni and north-westward, embracing Elgon. A great part of Uganda was

forested, and the forest crossed the Nile north of Lake Albert and connected with the Ituri forest. The latter then extended northwards, on the Congo side of the Sudan-Congo border, till level with Mount Wati, and from there swept westwards across the south part of the Welle, with perhaps occasional indentations in the line, until it joined up with the forests of the French Congo.

Five thousand years ago, at the time the Egyptians sent their expedition to catch pigmies, the forest areas must have been very much greater, and then, probably, the natives of Central and North Central Africa had not yet begun to clear the ground. We know that then the Blacks extended farther northwards, and probably the heart of the forest in Central Africa was quite uninhabited. The people living on the edge of the forest gradually cleared and pushed southwards, allowing the blacks about Assuan, in their turn, to retire from that neighbourhood. Arab invasions from Arabia probably pushed the original inhabitants still further backwards.

In those days the forests may have extended down the Nile to Rejaf, have occupied all the Welle and penetrated far into the Bahr el Ghazal.

SEASONAL DISTRIBUTION OF RAINFALL IN THE BRITISH ISLES.

ALTHOUGH the seasonal variation of rainfall in these islands is comparatively small, it is of a highly interesting character, so that the detailed paper on the subject lately published by Dr. H. R. Mill and Mr. C. Salter, of the British Rainfall Organization, is specially welcome.* It is valuable not only because of the various facts elicited, and marshalled in a novel manner, but also because, the general causes of rainfall being now fairly understood, it gives an impetus to the profitable explanation of some of them by theory. The maps, which are based on records from 283 stations during the thirty-five years 1875–1909, and duly produced in the paper, show for each month of the year, and for seasonal groups of months, the percentage which the average rainfall of the month and season bears to the average annual fall, this being done by a series of "isomeric" lines.

It is generally admitted that thirty-five years is a period long enough to furnish satisfactory values of average rainfall, and when in 1910 Dr. Mill thought it desirable to revise the average rainfall values for use in "British Rainfall" the period chosen for the new average was the said thirty-five years 1875-1909. Although the Camden Square record cannot supply two consecutive thirty-five year periods, there are twenty-two overlapping periods of that length between 1858 and 1913, and it is found that the curves derived from them representing the march of the seasonal variation resemble one another very closely, with the result that the basis of thirty-five years may be taken as yielding a fair approximation to normal conditions. Moreover, if the differences between the overlapping thirty-five year periods are small in the case of Camden Square, they would be found even smaller, so Dr. Mill feels

* "Isomeric Rainfall Maps of the British Isles" (*Quart. Journ. R. Meteor. Soc.*, January, 1915).

assured, for stations of higher average rainfall. It is interesting, however, to note in this connection that there are two months in the year which appear from a comparison of the overlapping periods for Camden Square to be undergoing a progressive change, namely September, which has been becoming drier, and June, wetter of late years, and the September change seems to apply to the country as a whole, not only to the London district.

The salient features of the seasonal variation as exhibited by the maps in question are best exemplified by the months of January, April, July, and October. In January, although the general rainfall of the country as a whole is less than in December, the winter type of the distribution attains its full development, which means that highest percentages occur in the wet, hilly regions in the west and north-west, and the lowest in the dry, flat regions of the east. In the western Highlands, where January is actually the wettest month of the year, the percentage is as high as 12, whereas over East Anglia and Lincolnshire it is less than 7. By April, the driest month of the year over a large part of the country, a summer type of distribution is already apparent, the percentages falling in the wet western districts and rising in the east; but the differences in this month are not great. The lowest percentage, 5, occurs in the very region which had 12 in January, whilst over Central England the highest figure, approaching 8, is found. In April, too, a secondary relationship is brought out in that the inland districts are somewhat wetter than the coastal.

The map for July reveals the full development of the summer type of distribution, and is almost exactly the inverse of that for January. The highest percentage, 11, occurs in the dry Fen country, the only district where July is the wettest month of the year, although around London July is wettest next to October; the lowest, 7 or below, in all the wet hilly regions in the west, viz. Devon and Cornwall, Wales, the Scottish highlands, and the west of Ireland. It must be remembered, however, that the actual rainfall over the east of England in July is less than that in the west, where the percentage of the annual fall is lower. By October the conditions are the inverse of those in April, this month over the country as a whole being the wettest of the year, and the inland regions being drier than the coastal. The winter type of distribution, however, though in process of development, is not yet quite so apparent as is the summer in April,* the highest isomer, 12, passing right round the coast of England and Wales, and the lowest, 9, embracing central Ireland. In December the rainfall is the greatest of the year over the greater part of the wet western districts, and is nearly everywhere else greater than in January, whilst the winter type of distribution is scarcely less marked. For the British Isles as a whole the months of October and December, considering the relative areas covered by the various percentage values, are the wettest of the year, the percentage which their average fall bears to the annual average being in each case 10·6, but the area over which October is the wettest month of the year is greater than that over which December is; whilst in the generally driest month, April, the percentage falls as low as 6·1. For the twelve months the percentages for the whole kingdom are: 9·1, 7·5, 7·5, 6·1, 6·3, 6·6, 8·0, 9·5, 8·2, 10·6, 10·0, 10·6: but the figures, of course, are different with reference to England, Scotland, Ireland, and Wales taken separately.

Briefly, we may describe the character of the seasonal variation of rainfall in these islands as bi-phase; for whereas on the one hand there is a percentage excess

* The reason being that the transition from the summer to the winter distribution which already begins to show on the September map is nearly obliterated in October by peculiarities connected with the generally high autumn rainfall.

in the wet hilly western parts of the country during the winter half of the year (October to March), with maximum in December and January, and a percentage excess in the dry, flat, eastern parts during the summer half (April to September), with maximum in July,—on the other hand, throughout the country the isomeric values are lower during the spring half-year (January to June), with minimum in April, than during the autumn half (July to December), with maximum in October.

Altogether the subject looks mathematically attractive, and thinkers would do well to bear this in mind as further facts are brought to light. The interpretation of the main facts adduced in the paper is not difficult when one remembers that to get rain out of the atmosphere this must not only be supplied with vapour, but must be rising—either in the processes of cyclonic circulation or under the influence of orographic features, or both. The July maximum referred to above as occurring in eastern England is the well-known effect of excessive insolation in producing heavy summer thunder rains; the October maximum over a large part of the country, including the region with a high July rainfall, is due to the increased intensity of cyclonic action at a season when the rapidly cooling land surface chills the rainy Atlantic winds as they reach these shores; but the December and January maximum in the western districts of high annual rainfall is somewhat enigmatical. These are the months when cyclonic circulation is most frequent and intense over the entire country, yet it is only among the mountains of the west that it provokes a rainfall higher than in October, the temperature in the flat eastern districts apparently falling too low in winter to permit a rainfall as heavy as in autumn. This circumstance, coupled with the fact that the greatest January percentage excesses over the October values occur not only in the west as a whole, but specially in the most mountainous districts, would seem to suggest that the winter excess with respect to autumn in that region has an orographic rather than a cyclonic origin.

On the other hand, there are indications in the monthly charts of mean atmospheric pressure over the British Isles (see Bartholomew's 'Atlas of Meteorology') that, although the barometric gradient from south-east to north-west is steeper in January than in October in accordance with greater intensity of cyclonic movement, the paths of the rainy atmospheric depressions lie more across the country in the autumn, tending to skirt the western seaboard in the winter, and if such indications are correct the small January rainfall in the east of England as compared with the October would be wholly or partially accounted for.

A very difficult problem of great geographical interest in the study of British rainfall, which has often been discussed by Dr. Mill and which we may hope he will not find impracticable of ultimate solution, is that of separating cartographically the orographic rains from the cyclonic or "meteorological" rains. Once this can be done, we shall be able to see what proportion of the higher annual rainfall in the west than in the east of Britain is due to the accident of the high ground being mainly situated there, and what proportion to greater proximity to the Atlantic Ocean.

L. C. W. B.

REVIEWS.

EUROPE.

'Highways and Byways in Lincolnshire.' By W. F. Rawnsley. Illustrated by F. L. Griggs. (London: Macmillan. 1914. Pp. xviii., 519. *Maps and Illust.* 5*s. net.*) According to the lights of this well-known series, full justice is done by both writer and illustrator of the present volume to one of the most

interesting counties in England. The writer discourses pleasantly (if with some tendency at times towards colloquialism) on matters descriptive, literary, and historical; the artist is thoroughly at home whether in portraying the magnificent architectural subjects with which the county abounds, or in catching its characteristic scenery and atmosphere.

ASIA.

Babylon.

'The Excavations at Babylon.' By Robert Koldewey, translated by Agnes S. Johns. London: Macmillan & Co. 1914. *Illustrations.* 21*s. net.*

This book illustrates the remarkable series of excavations which have been carried out at Babylon with patient continuance from the year 1899 to 1911, under the direction of German archæologists. In it we find not only the latest literary contribution to a subject of world-wide interest, but a series of carefully executed pictures and plans without which the technical references to architectural and topographical features would be hardly intelligible. The work began with the opening up of the Procession Street of Marduk in 1899, and investigations followed on the site of the Temple of Ninmach, the centre of Amran, and the principal citadel. The great gate of Ishtar was excavated in 1902, and since then digging operations have been carried out at many points which have practically unearthed successive layers of foundations, indicating the plans of successive cities from the time of Hammurabi to that of the Persian conquest. Centuries of local history have thus been revealed by the testimony of Babylonian bricks, and by the vainglorious records of the kings who added from time to time to the magnificence of the imperial capital and left their records about on stones and tablets. The book is but a plain and simple story of the results of unremitting labour, but the illustrations, which include reproductions in colour of the designs in enamel which decorated the walls of the principal gates and palaces, are of exceptional interest. The character of early Babylonian decoration in no way foreshadows the development of style which is to be found in the later Persian enamelled brickwork. The latter is almost modern in conception and execution. A word must also be said for the topographical plans with which the book is well supplied. They are delightfully clear and instructive.

T. H. H.

Western China.

'On the Trail of the Opium Poppy.' By Sir Alexander Hosie. 2 vols. London: George Philip & Son. 1914. *Maps and Illustrations.* 25*s. net.*

These volumes record the daily life spent by the author in two long journeys in the north-west and south-west of China, undertaken in 1910 and 1911 to investigate how far the suppression of opium cultivation was a reality. The results of the investigation are given in the official reports published as appendices at the end of the second volume. Briefly summarized they amount to this: In two of the provinces, Shansi and Sechuen, opium cultivation has practically been exterminated, while in Shensi, Kansu, Yunnan, and Kweichou the cultivation has decreased to the extent of perhaps 75 per cent.

But the book is devoted more especially to a description of the country traversed each day, rather than to the matter which forms the subject of his official reports. The incidents of the day, the botany of the countryside, the local handicrafts, the produce met *en route*, mills, bridges, and crops, all pay

their toll of interest, and it may safely be said that there are few men better qualified than the author to tell of the varied industries and commerce of China.

The routes travelled have as a rule already been described by Sir A. Hosie or by others, but a *détour* from the main road made in Kweichou from Lang-tai to Ta-ting through the mountains near the headwaters of the Wu-chiang and Chen-yuan rivers seems to form an exception.

With regard to opium, there is one point which does not seem to be clearly brought out. So far as can be gathered from the book, the farmers seem to have been reluctant to give up such a profitable crop. "It is the Emperor's will; We must obey," was the answer given on one occasion to an inquiry as to their behaviour, when crops were torn up by the soldiers. But the answer seems insufficient to explain their compliance, nor is it shown from what quarter came the pressure that brought about this mighty reform. When Tso Tsung-tang started his famous campaign against Yakub Beg in 1876, the penalty of death was instituted for smoking opium. But, if an aide-de-camp of the general is to be trusted, the troops not only planted crops to meet the needs of the next year's campaign, but also grew opium in the mountain valleys at a distance from the main road. Tso Tsung-tang was a man of his word and living among his troops, while the Emperor in 1910–11 dwelt in a corner of the empire far removed from the great opium-growing centres in Sechuen, Yunnan, and Kweichou, and the last days of his dynasty had almost arrived. And yet in Kweichou and Yunnan, where opium passed as currency and bulky crops were valueless on account of the difficulty of transport, the edict was obeyed, and only in a few places were there collisions between the people and the soldiers, who came to pull up crops which they themselves valued as opium smokers.

In other parts of China, beans, rape, and other oil-producing plants are taking its place, but in Kweichou the author's own attendants commented on the decrease in traffic, due as they presumed to the destruction of the poppy.

Will the time ever come when China will realize that the beauties of the country might be made as profitable to her as they are to Japan, and that the first thing needed to encourage an influx of foreign visitors and foreign money is decent inns? The loathsomeness of the taverns and hovels in which travellers have to spend their nights is again and again reverted to by the author, and with good cause. But the loess fields of the north-west, the cañons of the Yellow river, the fertility of Sechuen, and the wonders of the limestone region between the Yangtse and the West River, together with the flowers and the trees which gave a charm to each day's journey, are features which dwell upon the memory of writer and reader. W. R. C.

Travels in Northern China.

'A Woman in China.' By Mary Gaunt. London: Werner Laurie. [1914.] 15*s. net.*

The authoress has furnished us with a picturesque and occasionally amusing record of her wanderings in Northern China. The drollness of Mrs. Gaunt's Chinese guide and incidents of daily travel form a pleasing relief to the cruel horrors that form apparently so essential a part of all recent Chinese annals. One of the more interesting localities visited was Jehol, the hunting palace of the Manchus, on the outermost edge of the province of Chihli. Here, it may be remembered, in 1793, the Emperor Chien Lung received Lord Macartney, the first British ambassador to China, and Sir George Staunton wrote an interesting narrative of the journey. The photographs that illustrate the park, the lakes, pavilion, temples, etc., of Jehol are decidedly interesting, and seem to

disprove Sir George Staunton's lament that there is a ubiquitous dearth of forest trees and vegetation throughout this part of the country. Readers at all familiar with the wealth of recent literature on China will understand that the present work contains little beyond the average impressions of a cultivated tourist who from the necessities of the case was unable to devote time to serious investigation. In accordance with the not very praiseworthy modern practice, the book is profusely illustrated with small photographs of a uniform size. Surely landscapes, mountains, river scenes, towns, whole stretches of the Great Wall, portraits, small groups, and elaborate but smaller objects such as the astronomical instruments on the eastern wall of Peking require some discrimina- as regards the scale of reproduction.

Although most of the localities described are fairly well known, an index map showing the line of route and positions of the places mentioned in the narrative would have added to its general interest.

Assam and the N.E. Indian Frontier.

'History of Upper Assam, Upper Burmah, and North-Eastern Frontier.' By Colonel L. W. Shakespear (2nd Gurkhas). London: Macmillan & Co. 1914. 10*s. net.*

There are few parts of India less known than those covered by the title of the present work. Most of this region which the author describes to us as more or less a *terra incognita* and at present largely covered by impenetrable jungle, was once the centre of thriving communities, and possessed at one time of important buildings such as forts and temples connected by old raised roads, the remains of which are still clearly to be seen in many parts. It is generally assumed that climatic conditions tended largely to bring about subsequent decay, for the climate is distinctly enervating, and each race that has settled there has in course of time lost its vigour and been supplanted by hardier folk, who in their turn have succumbed to love of ease and luxury. The disappearance of cities, canals, and other landmarks of the past is attributable to the soft alluvial soils of the valleys, which have often permitted the rivers to cut for themselves fresh channels, frequently destroying and carrying away the towns and buildings which history tells us did exist along their banks.

The early history of Assam is mostly legendary, but enough has been elicited by authorities like Meyer, Hannan, Bryan Hodgson, and others to connect the events of those times with historical landmarks of adjacent countries with which Assam had easy intercourse. Coming down to later times, three principal kingdoms claim notice, viz. the Kacharu, Kocches, and Ahoms, whose zenith of power arose at 1230, 1560, and 1700 respectively.

The later annals of the countries, of course, are in the main narratives of the European travellers and explorers from the east or west, who have placed on record all that has been ascertained regarding the tracts traversed. These chapters and sections are mostly dealt with geographically, and comprise the experience of Cooper in the Mishmi hills, Needham from the Sadiya side, Prince Henry of Orleans in his journey across south-west China, and various other expeditions.

As a collection of narratives and data regarding a region of unusual complexity whose literature it is often difficult and yet desirable to trace in view of the unexploited and obscure character of these frontier regions, this handbook is a useful contribution: credit being especially due for a good index, for well-selected photographs, some coloured plates, and a useful bibliography.

An Ornithologist in Siberia.

'A Summer on the Yenesei.' By Maud D. Haviland. London: Edward Arnold. 1915. 10*s.* 6*d. net.*

Without displaying the fact on the surface, this book contains some original work and many observations of considerable value. It claims attention both on account of its charming descriptions of bird-life on the "tundra," and as an example of what keenness and skill can do in bringing to light the essential points in the life-history of a country which is utterly desolate and forlorn. Whether it is in connection with wild birds or shy natives, Miss Haviland proves her ability as a close observer. Her passing observations on the aborigines and the Siberian colonists are of real interest.

The writer, with her companions, voyaged down the Yenesei to Golchika, an island in the estuary which forms the mouth of that river. Two months were spent here—all that the short summer season allowed—for the birds were already preparing to move southwards in mid-August, and the travellers were all but caught in the ice of the Kara Sea on the homeward voyage. In spite of having been preceded by Seebohm, Miss Haviland's work in the ornithological line is by no means a repetition of that classic 'The Birds of Siberia.' Nowhere is there greater need for prolonged investigation than in a region where the avifauna consists of summer visitors. This is shown by comparing the bird-notes collected in any one locality, in different years, by the three observers—Messrs. Seebohm and Popham, and Miss Haviland. Species that one visitor records as very scarce are noted by the next as being quite common in the same locality another year. Seebohm's list of species is, therefore, no longer a reliable guide to the birds that summer on the lower Yenesei, for varying annual climatic changes cause corresponding pulsations in the bird population.

Some interesting side lights are thrown on the life and labours of the Siberian colonists on these outskirts of Greater Russia. New-comers and aborigines seem to work as well together as Russian always does when thrown with Asiatic. The natives are treated liberally, obeying their own laws and being judged by their own people. The system of taxation is pronounced to be a mistake; for, assessed as it is on the clan and not individually, the family life—which is almost religion to such people—is being destroyed. The tribes tend to break up and scatter in order to escape the tax. Drink is, of course, a curse to them when in contact with the Russian; the long winters alone in the tundra, away from vodka, have probably been their saving. But it is noteworthy that simultaneously with the news of war, Russian officials appeared by magic, even on far-off Yenesei, to carry out the Government's crusade against alcohol. The same paternal Government encourages colonists, judiciously compensating them for their rough work of pioneering by exemption from military service. The general reader will find pleasure in Miss Haviland's word-pictures of the bird-life, of the wild-flowers, and of the spell of the northern waste itself. There is also a very definite addition to our knowledge of the ornithology of that particular locality. The illustrations prove how very essential it is to be able to take good bird-photographs in these days. The omission of a sketch-map is not justifiable, especially when the reader is transported to such an out-of-the-way place as Golchika, and one repeatedly wishes to compare latitudes.

D. C.

'Travels in the Mogul Empire, A.D. 1656–1668.' By François Bernier; translated and edited by A. Constable, second edition revised by Vincent A. Smith. (Oxford: University Press. 1914. Pp. lii., 498. *Maps and Illustrations.* 6*s.*) The present editor has applied various emendations to the work of his predecessor, and refers to a few important errors in a preface. The book, though in great measure historical, is also of high interest to the student of travel in the East, and the original maps, simple though they are, are worth careful inspection.

'The English Factories in India, 1646–1650.' By W. Foster, C.I.E. (Oxford: University Press. 1914. Pp. xxxii., 363. *Frontispiece.*) This is an important addition to the Series records of early British activity in India, published under the patronage of the Secretary of State for India. Like its predecessors, it consists of a calendar of documents preserved in the India Office, the contents of each document being summarized and extended quotations being frequently made. The last are not only of general interest, but sometimes of geographical value.

'The Island Dependencies of Japan.' By Charlotte M. Salwey. (London: E. L. Morice. 1913. Pp. ix., 149. *Maps and Illustrations.* 5*s.*) This is a simple account, historical, geographical, and descriptive, of Formosa, the Ryū Kyū, Bonin, Kuril, Pescadores, and other islands, and of Japanese Sakhalin (Karafuto). It contains much evidence of careful study and research, and demonstrates clearly the varied interests of these lands. It has suffered from inadequate revision in proof, and (generally for that reason) there appears here and there a hard saying, such as this reference to geological history—"Possibly, Japan itself had a nearer proximity to the great continent of China, or Russia on the western side."

AFRICA.

The Kavirondo and their Country.

'Alone in the Sleeping Sickness Country.' By Felix Oswald, D.Sc., F.G.S., F.R.G.S. London: Kegan Paul, Trench, Trübner & Co., Ltd. 1915. *Seventy Illustrations and a Map.* 8*s.* 6*d. net.*

Dr. Felix Oswald went to British East Africa in 1911 to examine Miocene deposits on the east coast of the Victoria Nyanza in the hope (which was realized) of discovering fossils, and thus adding to our knowledge of the past history of the continent. With the results of these investigations he is not concerned in the book under notice. The deposits he examined were situated in a region occupied by the Kavirondo—a happy circumstance since it enabled the author to make a close study of that people, who are noted chiefly in that, like the dwellers in Eden, they are naked and not ashamed. Dr. Oswald fills in many details omitted by previous students of the Kavirondo, of whom he leaves a very pleasant impression. The author finds a strong resemblance between the Kavirondo in their primitive condition and the early Britons; moreover, he was "irresistibly reminded of the similarity between the British rule in Africa on the one hand and the Roman domination of Britain on the other." The Kissii, the only other race through whose territory Dr. Oswald passed, wore clothes indeed, but were an inferior people to the Kavirondo.

Considerable areas in the district in which the author worked had been rendered desolate by the ravages of sleeping sickness, and on one occasion he intended camping at a spot which the natives, stricken by the plague, had just abandoned. Dr. Oswald was himself bitten by tsetse fly; happily no permanent ill effects followed.

The value of this book lies largely in its detailed and precise information. We

get a careful account of all the rock formations on the route traversed, which was from Karunga bay to Kavirondo gulf, and indications as to the value of the land for development by Europeans. The necessity of afforestation in all districts where this is possible is rightly insisted upon. The author describes vividly the insect plagues encountered. We hear incidentally of the trials attendant on fossil hunting in places where the puff-adder abounds, leopards lurk, wasps are aggressive, the heat is 150° in the shade, and one's native "assistants" have a bouquet compared to that of putrid onions.

Evidence was found that the former level of the Nyanza was 300 feet above its present level (see pages 120 and 129). On terraces which probably marked the former level Dr. Oswald discovered stone implements, which he thinks may be assigned to the period when the Bushmen occupied the country. Finally, we may commend the last chapter as containing one of the best accounts we have noted of what may be seen—by the trained eye—from the carriages of the Uganda railway. Many readers, too, will be relieved to find that there are no stories of hunting exploits in the book.

The photographs of scenery are good; those of the people are mostly too small to be very effective. F. R. C.

AMERICA.

PATAGONIA.

'Northern Patagonia: Character and Resources.' Vol. 1. Text and Maps by the Comision de Estudios Hidrologicos, Bailey Willis, Director. (Ministry of Public Works, Argentine Republic.) New York: Scribner Press. 1914. *Maps and Illustrations.* $8 *net.*

The Argentine Government, anxious to attract colonists and visitors to the regions of the Argentine Patagonia, and fully alive to the value of advertisement, has issued a most comprehensive guide to the railway recently constructed from Port Antonio on the Atlantic coast (at the head of Gulf San Matias) to the lake region of Nahuel Huapi, which lies in the Andine region about due west of that port. From Nahuel Huapi an extension into Chile across the great divide is apparently a very practical corollary. The guide is complete. It is supplied liberally with photographs and with a separate volume of map illustrations which leave nothing wanting in information as to the topography and general physical appearance of the country and its economic advantages. Railway construction, after bridging the waterless track which extends westwards from the coast for rather more than 100 kilometres to the Valcheta depression, passes through a district which differs in many essential respects from the generally accepted notions of the Patagonian pampas. It is far more rugged and broken; and there has consequently been none of the rapid surface line-laying which has so often led to ill-advised alignments with excessive grades, but which promised quick development of traffic and early dividends. The whole length of this line of 630 kilometres from the Atlantic coast to the yet undeveloped "city" of Nahuel Huapi passes through a country whose resources are chiefly pastoral, in which local traffic will be derived from grazing and irrigation districts. It is a traffic which in itself would justify the construction of a railroad for business purposes. The rapid output of it has been subordinated to the necessity for very careful surveys, and it is to the gradual recognition of this necessity, no doubt, that of late progress in railway development in Argentina has appeared slow. It is worth noting that the earliest examination of the route as a practical commercial line was made by Dr. Francisco Moreno, a Gold Medallist of the Royal Geographical Society. Settlements have already been established at several points along the

route, the most important perhaps being that at Maquinchao, about two-thirds the distance from San Antonio to the Andine foothills, to which point the line is apparently already open. Here, or at Marilantquen, which is not far west of Maquinchao, will be the junction for a railway striking southward and skirting the base of the Andes. As long ago as 1902 a railway was projected which should run parallel (approximately) to the San Antonio—Nahuel Huapi line, south of it, connecting Port Madryn *viâ* the Welsh settlement of the Chubut (following generally the course of that river) with the town of Esguel in the valley of "16th October"—the valley which formed the most important feature in the boundary dispute between Argentina and Chile at the beginning of the century.

That line will, it is hoped, achieve construction eventually, after the completion of the one under review. At present it is exactly where it was in 1902, *i.e.* it extends from Port Madryn to Rawson on the Chubut and no further. No line projected from the Atlantic coast across Patagonia to the Andes can afford to neglect the ultimate prospect of a trans-Andine extension with the Pacific. That from Nahuel Huapi has already been surveyed, and as it proves to be feasible it will eventually be possible to travel by rail to Valdivia from the lake region *viâ* the Cajon Negro. 'Northern Patagonia' suffers but little from the literary limitations of ordinary official style. It is full of interesting information, and even if the story is confined to plain statements of practical value to prospective settlers, it is easy enough to gather from between the lines as well as from illustrative photographs that there is here a future opening for the seeker after all that is new and beautiful in mountain and lake scenery such as probably exists nowhere else in this much-travelled world. The Southern Andes with their wild contrasts of snowfield and valley, purple and scarlet with the autumn tints of the beech woods, their rugged outlines and totally unexpected visions of deep-seated lakes lying smooth and soft beneath wind-swept heights, offer new fields for the artist and the traveller of inexhaustible beauty. They will soon be opened up to the European visitor, and this Andean Switzerland will gradually become the playground of the world. Already it may be said that the great glacier-fed lake of Nahuel Huapi has been prepared for the coming of the sportsman by the introduction of fish. This is a new development which has proved most remarkably successful, and undoubtedly adds to its attractions. Big game is scarce in the Andes. The huanaco is too tame for sport; the huemul is a deer of but inferior personality; the puma is no doubt attractive, and the wild cattle may still be reckoned as within the sphere of sporting activities; but, on the whole, it must be admitted that it is the natural beauty of the country, the glory of its mountains and lakes and its rivers, which constitutes the chief call of Patagonia to the European.

T. H. H.

'Through the Grand Canyon from Wyoming to Mexico.' By E. L. Kolb. (New York: The Macmillan Co. 1914. Pp. xxi., 344. *Map and Illustrations.*) This is a delightful book; one which is of fully sufficient interest and excitement to be enjoyable to readers who know nothing of the Grand Canyon. The adventurous journey is one seldom made, and this account will take rank with any by those who made it, or part of it, before the Messrs. Kolb, who refer to the work of their predecessors in an appendix and elsewhere. And the journey was not one merely of adventure; the travellers had been living near the Canyon for some years "following the work of scenic photography," and it may be guessed that this volume contains many evidences of their skill.

'Panama: the Canal, the Country, and the People.' By Arthur Bullard (Albert Edwards). (New York: The Macmillan Co. 1914. Revised and

enlarged edition. Pp. xiv., 601. *Maps and Illustrations.* 8*s.* 6*d. net.*) First published in 1911, Mr. Bullard's work on Panama has now been brought up to date and embellished with additional photographs. Half of it or more is historical. The rest records facts and impressions about country and people at the present day, and about the construction of the Panama canal, in the picturesque style of American journalism. A folding map of the republic of Panama is almost illegible.

ANTHROPOGEOGRAPHY.

Early Man in the Channel Islands.

'Prehistoric Times and Men of the Channel Islands.' By Joseph Sinel, Curator of the Jersey Museum, etc., with a foreword by Dr. Arthur Keith. Jersey: J. T. Bigwood. 1914. Pp. 135. *Numerous Maps and Illustrations.*

Few more interesting works than this have ever been published on the past history of man in North-West Europe. But for the indirect consequences of the present war, which took away the reviewer to America with Mr. Sinel's book in his hand (so to speak), this treatise on one of the most interesting phases of Palæanthropology should have received earlier notice in the pages of the *Geographical Journal.* There is so much "palæogeography" (if I may harp on the Greek adjective) in this book that a notice of it is quite in keeping with the geographical limitations of our *Journal.* It shows us convincingly how the Channel Islands (and most recently Jersey, the largest of the group) were the hill crests of Northern France overlooking the broad valley which is now the British Channel; and how, long after that channel was formed or reformed in the latest among the many insulations of England, Jersey, Guernsey, Alderney were islet-crowned peninsulas of France advancing into the waters of the ever-enlarging strait which separated Normandy from Devonshire. By this time, with Britain once again an island, or at most connected with Calais by narrow sandy flats, Neanderthal man had been evolved somewhere in France or the Rhine Valley, a much later growth of time than *Homo sapiens,* and in some respects a throw-back to the brute. Neanderthal man had a very large brain, but one which may have generated only a humble intellect. He had retained from the original generic Homo lowly configurations of skull and limbs, markedly Simian features, in fact. But in respect of his teeth, he had departed far more from the anthropoid than the modern Englishman, and very much more so than the black Australian or the Negro. This and other important traits in *Homo neanderthalensis* (no longer rightly owning his first given name of *primigenius*) were made known to us by Dr. Arthur Keith; and the chief evidence which put Dr. Keith on the right track came from Jersey. Apparently Neanderthal man arose so comparatively late in Earth-history that the overland route to England was already eaten away by the desire for union between the eroding waves of the North Sea and these of the British Channel. So far no trace of this aberrant species of the genus Homo has been found in our country. He ranged seemingly from Austria and the Rhine to Gibraltar, France, and Belgium. But he certainly inhabited Jersey, so that we can claim him posthumously as a subject of the Duke of Normandy and British King-Emperor.

Down to about three years ago Neanderthal man was looked upon as the first definite stage behind *Homo sapiens,* back towards the ape ancestry. But we now know that *sapiens* preceded him in time, in England at any rate, and that the difference between the two was probably so considerable that even if they met and mingled connubially there was little likelihood of their generating a mixed progeny which has survived to this day. So that all talk of this and

that modern race being "neanderthaloid" has been swept away by Dr. Keith's discoveries. Least of all is the Australoid akin to Neanderthalensis. The problem concentres on the teeth. The teeth of this clumsy, shambling, big-brained, heavy-browed human were more specialized than the teeth of *H. sapiens* for the proper grinding-up of a hard vegetable diet. The canines were even smaller than those of modern man, and the molars were "taurodont" and not "cynodont" like ours; which means that they had the spaces between the fangs filled up with cement instead of being low-crowned like other human teeth.

Mr. Sinel's book, however, treats of man in Jersey and Guernsey not merely in most remote times beyond the faintest glimmering of history, but right on through the Palæolithic, Neolithic, and Bronze ages, down to the advent of the iron-using Aryans, almost to the coming of the Romans. It is a work of the greatest interest and of much scientific value. Its maps and diagrams are clear, and its photographs of skulls, of the sites of discoveries, of stone and flint implements and utensils, of gold torques, and submerged forests are important contributions to Palæanthropology, and to our study of the prehistoric life of man in north-west Europe. Who would have thought that all this could have come out of the tiny Channel Islands, that they could have had such a far-reaching and honourable past in human history? Another triumph for the "little countries"!

H. H. Johnston.

HISTORICAL GEOGRAPHY.

Early Portuguese Nautical Science.

Joaquin Bensaude, 'L'astronomie nautique en Portugal à l'Époque des grandes déscouvertes.' Berne: Max Drechsel. 1912.

'Regimento do Astrolabio e do Quadrante. Tractado da Spera do Mundo.' Réproduction fac-similé. Munich: Carl Kuhn. 1914.

Luciano Pereira da Silva, 'A astronomia das Lusiadas.' Lisbon. 1913.

A very important discovery was made, in recent years, in the Royal Library at Munich, throwing light on the history of nautical astronomy with reference to the Portuguese discoveries of the fifteenth and sixteenth centuries. The little book that has been brought to our knowledge is entitled 'Regimento do astrolabio e do quadrante.' Only this one copy is known to exist, but it is one of many prepared for the use of Portuguese seamen under the superintendence of the Mathematical *Junta* or committee, appointed by King John II. of Portugal. A facsimile of the original in the Munich Library has been presented to our Society.

It is in two parts. The first part contains full instructions for finding the latitude with seventeen examples, rules for correcting observed altitude of the polar star, a list of sixty latitudes on the west coast of Africa as far as the equator, rules for placing tracks on a chart, and tables of sun's declination for the year. The second part is a translation of the treatise on the sphere by Sacrobosco, who was a Yorkshireman from Holywood near Halifax, as the name implies.

The discovery led to the publication of a learned work by Senhor Joaquin Bensaude. The author shows that the tables of declination are derived from a Portuguese and not, as has hitherto been incorrectly assumed, from a German source. It appears that in about 1473 a learned Portuguese Jew, named Abraham Zacuto, composed a work in Hebrew, entitled 'Almanac Perpetua,' in which he gave the tables of declination. On the Mathematical *Junta* of King John II. there was another Jew called "Messer José." His full name

was José Vizinho, Physician to the King. "Messer José" translated the 'Almanac Perpetua,' and thus the means were provided for finding the latitude when the Portuguese discovery ships were so near the equator or beyond it that the pole star, always used in Prince Henry's time, ceased to be available. The *Junta* advised the use of the astrolabe for observing altitudes. This instrument, in a very complicated form, had been used for astronomical and astrological purposes for centuries by the Moors of Cordova and Bagdad, and was well known to Zacuto and Vizinho. They appear to have simplified it by taking out all the parts except those necessary for taking altitudes. The one used by Vasco da Gama must have been very large, for when he landed at the Angra de Santa Helena to observe with it so as to get a more accurate result than the motion of the ship allowed, the instrument was suspended from a triangle. There is a curious old book in the Coimbra University Library, entitled 'Campendio del arte de navegær por el Licenciado Rodrigo Camorano,' which gives full instructions for the construction of a wooden or metal plane astrolabe.

The 'Regimento' found at Munich is an example of the little navigation books, based entirely on Portuguese studies, which were issued to the seamen of that nation during the age of discovery.

Hitherto a passage in the 'Decadas da Asia' of Barros has been interpreted to mean that the Portuguese were supplied with tables of sun's declination from the Ephemeris of J. Müller of Konigsburg (known as Regiomontanus), and that the plane astrolabe was also provided for the Portuguese by Martin Behaim of Nuremberg.* Humboldt held this opinion, and Ziegler, in 1874, wrote that, "if Germany did not take a part directly in the great discoveries of the fifteenth and sixteenth centuries, it was German savants who, by their contributions to science, gave the most essential aid." Finally, the German Emperor, when he was at Lisbon in 1905, claimed that Portuguese discovery owed its success to German science.

The little book in the Royal Library at Munich quite disposes of such a claim. Senhor Bensaude gives conclusive evidence that the tables of declination in the 'Regimento' were taken from the 'Almanac Perpetua' of Zacuto, and not from the Ephemeris of Regiomontanus. The plane astrolabe was as little due to Behaim. It is unjust that the Portuguese of their heroic age should be robbed of any credit that is due to them. Their discoveries as well as their science were their own.

Senhor Bensaude's work contains a very able and learned discussion of the subject, which is one of great interest to comparative geographers. His views have the full concurrence of Prof. Gallois of Paris (*Annales de Geographie*, No. 130, July 15, 1914), as well as of Prof. Wagner of Göttingen.

Since the appearance of Senhor Bensaude's work, Prof. Luciano Pereira da Silva has written an interesting little book on the astronomy of the *Lusiadas* of Camoens, which first appears in numbers in the *Revista da Universidade de Coimbra*. While treating of all the points which his countryman Bensaude has so ably brought to light, Prof. Pereira da Silva quotes passages from the *Lusiadas* which show the complete knowledge possessed by the great poet, of the nautical science of his day. C. R. M.

* The claims put forward on behalf of Behaim were, it will be remembered, refuted by Dr. Ravenstein in his learned memoir accompanying his facsimile of Behaim's Globe (*Journal*, vol. 33, p. 679), which also gave a good deal of information on King John's Junta. In fact, Senhor Bensaude acknowledges his indebtedness to Dr. Ravenstein's work for the stimulus to his own study.—[Ed.]

GENERAL.

Health in the Tropics.

'Tropical Diseases.' By Sir Patrick Manson, K.C.M.G. London: Cassell & Co. 1914. *Illustrations and Diagrams.* 12*s.* 6*d. net.*

'Tropical Diseases: a Practical Handbook.' By H. C. Lambart, M.D. London: Griffin & Co. 1914. *Illustrations.* 8*s.* 6*d. net.*

There has been, within the last few years, a great advance in pathological research into tropical diseases, while new treatment has been adopted for many diseases peculiar to the tropics, so a thoroughly revised edition of Sir Patrick Mason's well-known manual has been rendered necessary. For instance, there is now little doubt but that yaws is produced by a germ closely resembling the parasite of syphilis; that beri-beri, the scourge of Malaya, results from a diet of over-milled rice; and that the deadly disease so common in the Philippines and the Yangtze Valley is produced by a water-borne parasite known as *Schistosomum Japonicum*. Then the new methods recently introduced in the treatment of familiar diseases, such as salvasarsan for yaws, antimony for sleeping sickness, and emetine for some forms of dysentery, are carefully described and criticized by the author.

A new feature of great value to the tropical practitioner is the appendix on Protozoa, which gives the latest information on the parasites which are such important factors in the causation of disease.

Dr. Lambart's textbook is perhaps more adapted for the traveller and resident in tropical countries than for the practitioner. It gives adequate information on the principal tropical ailments (omitting all non-essential matters), and the alphabetical classification makes reference easy. Though the author has only room for the briefest summary of the history and etiology of each disease, he gives the latest results of scientific research, and has drawn largely on the works of specialists, especially on that of Sir Patrick Manson. Aids to diagnosis, a very full therapeutic index (prescriptions) hints on the treatment of bites by venomous animals and snakes, advice on sanitation, diet, etc., add much to the practical value of this handbook.

In snake-bite the approved treatment with anti-venene injections discovered by Dr. Calmetti of the Pasteur Institute, Lille, is lucidly explained. This anti-venene serum has proved very efficacious for the bite of cobra, krait, and Russel's viper. But unfortunately these serums are in a sense homœopathic, and a serum prepared for one kind of venom is practically useless for another.

E. A. R. B.

'Some Geographical Factors in the Great War.' By T. Herdman. (London: Brown. *N.d.* Pp. 71. *Maps.* 9*d.*) The five chapters comprised in this little book are cast somewhat in the form of lectures. They deal with general considerations, the great land gates, the seas, the commercial war, and the problems of nationality. The scope of these topics is outlined in the first few pages, with a commendable restraint, which is to be observed throughout the book, in the direction of keeping the discussion within strictly geographical limits. The last chapter gives a clear presentation in brief of the vast difficulties in the way of adjusting European frontiers and nationalities.

'Nature Notes for Ocean Voyagers.' By Captains A. Carpenter and D. Wilson-Barker. (London: Griffin. 1915. Pp. xvi., 181. *Maps and Illustrations.* 5*s.*) The possession of this book ought to go some way towards relieving what is commonly called the tedium of an ocean voyage. It is

designed for the amateur, being written "for the many voyagers who feel a need for information on their unfamiliar surroundings at sea." With the limitations of such readers kept judicially in view, the authors discuss the physical conditions, life, and vegetation of the oceans, weather, and the movement of waves, and also traditions and sea-lore, so that their stock-in-trade is certainly comprehensive. There are many illustrations, both of the beautiful and of the curious, and also maps, most of which suffer from the common complaint of over-reduction.

THE MONTHLY RECORD.

EUROPE.

Regulation of the Lake of Lugano.—The question of the regulation of the Lake of Lugano (Lago Ceresio), which had been under discussion spasmodically for some years, has lately been brought somewhat nearer solution, though it is hardly likely that actual steps towards the realization of the project will be taken under existing circumstances. Two separate objects have been in view from time to time —the regulation of the rise and discharge of the lake so as to ensure a relatively constant level and obviate damage by floods; and the utilization of the supply for water-power and irrigation. Schemes in furtherance of one or other of these objects have been set on foot from time to time since 1874, but none has led to definite result, partly through the difficulty of reconciling opposing interests. The formation of the "Società della Tresa" in 1900, and the support given to its proposals by the Council of State of the Swiss Canton of Ticino, seemed likely to have a more positive outcome; but opposition was again encountered, and a new move was made in 1906 with a view to a regulation of the lake in the public interest (apart from the utilization of the water). The co-operation of Italy was sought and obtained for a thorough study of the question, and the elaboration of a suitable project was entrusted to Signor C. Ghezzi, who presents his conclusions in an elaborate report issued as No. 4 of the *Comunicazioni della Divisione dell' Idrographia Nazionale* at Berne. The report, which is accompanied by an atlas of charts and tables, deals exhaustively with the hydrography of the lake and its basin, on which it brings together in convenient form a mass of hitherto scattered or inaccessible data. The works proposed include the construction of a dam 71 metres long above the bridge over the Tresa, and of a sluice for the regulation of the discharge at low water; the correction of the bed of the Tresa down to a specified point, and the provision of a regular gradient of 2·5 per cent.; the widening of the Strait of Lavena, and the lowering of the bottom both here and beneath the arches of the bridge connecting Melide with Bissone. It is claimed that these operations would both lower the level of extreme high water and raise that of low water, besides affording improved facilities for navigation and increasing the minimum discharge of the Tresa from 4·5 to 8 cubic metres per second.

ASIA.

Anticipated Drainage Changes in Central India.—In the *Records of the Geological Survey of India* (vol. **44**, part 3, 1914), Dr. L. L. Fermor calls attention to existing conditions of drainage on the border-line between the Son (Ganges) and Mahanadi systems, changes which he thinks are bound, possibly within the present century, to lead to diversions of the upper courses of the Son and its tributary the Rer. The basin of the southward-flowing Hasdo, a tributary of the Mahanadi

which drains the greater part of Korea state, forms a remarkable wedge running up between those of the Son to the west and the Rer to the east; and as the distance to the sea by the Mahanadi is much less than by the Ganges, the Hasdo naturally has a much steeper gradient than the other two rivers, and reaches a much lower level than they in the area in question. This has enabled some of its tributaries to cut back the watershed to within very short distances (1 to 4 miles) of the Son and Rer, the intervening water-partings being extremely low—probably, on the side of the Son, not more that 50 feet in places above the bed of that river. Dr. Fermor discusses in detail the question of the localities where the anticipated beheading is likely to take place; much, of course, depending upon the nature of the rocks, which vary in hardness between the Gondwana sediments and archæan granites and gneisses, both which types are represented. The fact that, with the more rapid southward gradient, so much of the drainage still finds its way north of the Son, is probably due to the resistance to erosion offered by the Archæan axis. He suggests, however, that the Gondwana sediments were deposited by an ancient river flowing south-east through a breach in that axis, and that the Hasdo may be merely opening once more the ancient pre-Gondwana channel.

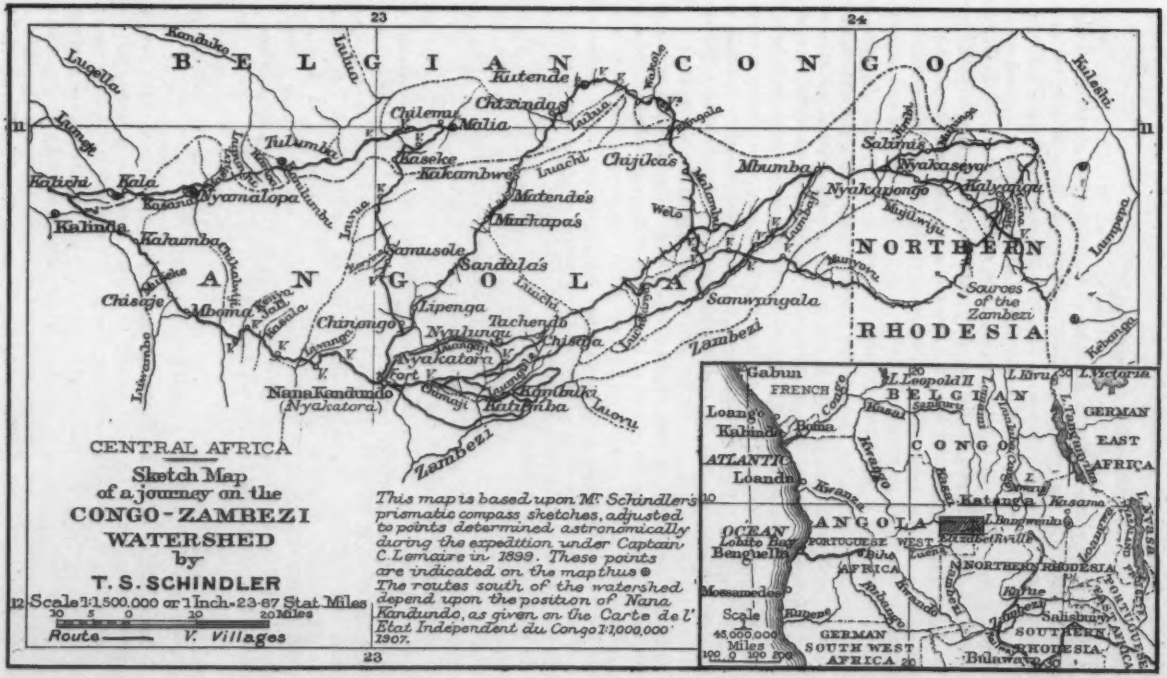
Vegetation of the Tinnevelly Hills.—In the *Records of the Botanical Survey of India*, vol. 6, No. 5, Mr. M. S. Ramaswami describes a botanical tour in the Tinnevelly Hills carried out by him and Mr. D. Hooper on behalf of that Survey. Besides a complete list of the plants collected, the paper contains some interesting notes on the altitudinal distribution of the vegetation of the district visited, and its affinities with that of neighbouring regions. The trip led the travellers to the inner slopes of the Ghats, which, in contrast to the generally bare slopes further east, contain much evergreen forest, frequently at low elevations. Above 2500 feet there are large stretches of moist heavy evergreen "shola," these slopes generally getting the full force of the south-westerly monsoon, as well as heavy showers during the north-easterly monsoon. The trees are very tall and of many different species, and the herbaceous vegetation extremely rich. The plants of the high elevations include species of *Clematis*, *Begonia*, *Lobelia*, *Rubia*, etc. Lower down *Strobilanthes* shrubs become abundant, followed by others belonging to the *Rubiaceæ* and *Acanthaceæ*. Near the foot of the hills there are species of *Euphorbia*, *Grewia*, *Dioscorea*, *Aristolochia*, and a host of Leguminous plants and Composites. In certain of the forests towards the north the preponderance of typical Ceylon plants was remarkable. The collections as a whole revealed an appreciable endemic element in the flora, making about 7 per cent. of the whole. Only a little over 2 per cent. were purely Ceylon species, against 10 per cent. peculiar to South Peninsular India; while 26 per cent. were common to the two regions. Of the remainder, about half were forms distributed throughout India, the other half extending in varying proportions to Assam, Burma, and Malaya. *Leguminosæ* and *Rubiaceæ* are the orders best represented.

Hydrographical Surveys in the Dutch East Indies.—Among other evidences of enterprise in their eastern possessions within recent years, the Dutch authorities have shown a praiseworthy activity in the survey and charting of the coasts of the islands, large and small, of the Malay Archipelago. A summary of the work done within the past five years, supplementing previous reports in the same publication, appears in the January number (1915) of the *Tijdschrift* of the Netherlands Geographical Society, accompanied by a chart on which the extent of the hydrographical work so far accomplished is clearly shown. From this it appears that the surveys have covered the whole of the coastal waters of Dutch Borneo and Celebes; those on the north side of Java and on both sides of the island chain to the east as far as the Solor group and western Timor; nearly the whole eastern

side of Sumatra and about a third of the western side, including the Nias and other groups of lesser islands; and portions of Gilolo and the western extremity of New Guinea, with the Aru islands. The largest unsurveyed area lies between Celebes, Timor, and New Guinea, including Ceram and Buru, the Moluccas and other small groups; but the whole of the south coast of Java and some two-thirds of the west coast of Sumatra have still to be taken in hand. Some of the work (such as that along the north side of Java) dates back to the eighties of last century or even earlier, but the greater part has been carried out since 1900, and that in the extreme east and west only within the past five years. It is not stated to what extent the triangulation of the coasts has been accompanied by soundings, but as the colouring of the chart shows, in places, fairly broad expanses of sea as surveyed, it may be supposed that the determination of depths has formed part of the work.

AFRICA.

A Journey on the Congo-Zambezi Watershed of Kadungu, Angola.—Mr. T. S. Schindler sends the following notes on the map published herewith: These prismatic compass sketches were made at different times during itinerating trips, and refer to the country on the extreme northern extremity of the Zambezi system. Besides being interesting as the divide between two large river systems, the country is attracting attention as being the natural line for railways that will connect the mines in Katanga with the port of Lobito, on the west coast, which will provide the shortest and consequently the cheapest route for conveying minerals from the large deposits in Katanga to the ocean. Once these two lines—the Belgian, which is being worked westwards from Elizabethville, and the Benguella railway, which is pushed forward from the west—have joined up, this will be accomplished, and, as a consequence, agricultural development will also result. So far practically nothing has been done in this direction, although the country is suitable for it. Cattle do well, and have so far been remarkably free from disease. From small experiments carried on, there seems no doubt that wheat could be cultivated in the dry season by irrigation. Most European vegetables will grow, and, of course, such native produce as has been cultivated by the natives, as mandioc, mealies, castor-oil, beans, bananas, plantains, pine-apples, and also other fruits that have been introduced (such as oranges, lemons, citrons, etc.). Rice, which was introduced only some ten years ago, does excellently, and tons of it are grown annually by the natives. The rainfall is good. Last wet season it amounted to 52·43 inches, which is probably below the average. The population is comparatively large. The people belong to the Va-Luena tribe. When Livingstone passed through their country, on his way to Loanda, they were a very small tribe inhabiting the region on the junction of the Luena river with the Zambezi. Most of the country now occupied by them was then under the sway of the great Lunda chief, Mwata Yamvo. Names of chiefs whom Livingstone mentioned, such as Skinte, Katema, Kakenge, etc., were in reality titles of offices held under Mwata Yamvo, and these names were given to successive holders of the positions. It was probably only after the death of this great chief that the Va-Luena in the south of his kingdom and the Va-Chokwe in the west encroached on his dominions and ousted the Va-Lunda, enslaving and killing many of them, until the rest submitted and were assimilated by the Va-Luena tribe in the region of the Congo-Zambezi watershed, from near the latter's source to as far as the northward bend of the Kasai. Apparently the Va-Luena also extended southwards from the Lwena river, and are being found as far as the junction of the Lungerungu and the Zambezi. In the south they are, however, called Va-Lovale (Ba-Lobale). On the left bank of the Zambezi, where the country is more hilly, and thus gave more natural



CENTRAL AFRICA

Sketch Map of a journey on the CONGO-ZAMBEZI WATERSHED by T. S. SCHINDLER

Scale 1:1,500,000 or 1 Inch=23·67 Stat. Miles

Route —— V. Villages

This map is based upon Mr. Schindler's prismatic compass sketches, adjusted to points determined astronomically during the expedition under Captain C. Lemaire in 1899. These points are indicated on the map thus ⊙ The routes south of the watershed depend upon the position of Nana Kandundo, as given on the Carte de l'Etat Independent du Congo 1:1,000,000 1907.

protection against the Va-Luena aggression, the Va-Lunda still hold their independence, but are much scattered.

AMERICA.

Natural Regions of North America.—A good deal of attention is being at present directed to the definition of Natural Regions as the basis for the proper understanding of the geographical factors by which man's activity is conditioned. Two papers have lately appeared in the United States in which the question is discussed in its bearings on North America. One of these, by Mr. W. L. G. Joerg, treating of the subdivision of that continent into Natural Regions, is published in vol. 4 (for 1914) of the *Annals of the Association of American Geographers* (Reprint, 1915). In the other, more limited in scope, Mr. W. G. Reed considers the climatic provinces of the western United States. Both writers are well acquainted with previous work in this direction, both of a general and special character, and both bear testimony to the value of the pioneer work of Prof. Herbertson, in his paper on the Natural Regions of the World published in the *Journal*, vol. 25, p. 300. Mr. Joerg makes some judicious remarks on the methods to be adopted, and while fully recognizing the difficulties arising from the variety of the elements to be taken into account—structure and relief, climate, vegetation, etc.—is evidently of opinion that results of real utility may be gained. Of the above elements one may predominate over another, and the problem is to evaluate their relative importance. Structure and relief will, *e.g.*, be the guiding principle in the delimitation of the Cordillera; low rainfall, in that of the Great Plains. The selection of the predominating element may be prescribed by the rank of the unit to be subdivided, and there may be a lack of coincidence between major regions and the minor regions which constitute them; for a mountain range may divide two of the former while itself forming one of the latter. The evaluations arrived at are, of course, subjective, and the criterion is not absolute accuracy but expediency. Mr. Joerg reviews in turn the considerable number of previous classifications suggested for North America, and by utilizing the most valuable points in each, arrives at one of his own, which is still put forward as provisional only. As concerned only with one of the main factors in the study, Mr. Reed's task is a simpler one, but even here there is room for considerable differences in the results reached by different students. For some purposes it may be practicable to establish temperature provinces or zones, and also to establish rainfall provinces, but both factors must be considered together in any classification which will throw places with similar climates into the same group and places with dissimilar climates into different groups. In the western United States the differentiation is not so much by latitude as by position east or west of the Sierra-Cascade Range, which divides regions distinct not only in the amount of the rainfall, but in the seasonal distribution both of rainfall and temperature. In the whole region to the west the conditions are so similar that it may be treated as a single province (the "Pacific Province"), though capable of subdivision for detailed consideration. Similarly the "Rain Shadow Area" to the east may rank as a province, characterized by deficient precipitation.

Canalization of the La Plata Estuary.—The improvement of the navigable channel leading up the La Plata estuary to Buenos Aires has for some years been a desideratum in view of the increasing draught of the vessels which make use of it. From 1905 onwards energetic steps have been taken to bring about the desired result, firstly by a detailed survey of the floor of the estuary, secondly by experimental dredging operations; and a general statement of results is given in the *Boletin de Obras Públicas*, published officially in the Argentine Republic, Tomo IX., Año 1913 (Buenos Aires, 1914). The chief obstacle to navigation by vessels of large

draught is the bar (known as the Barra de Punta Indio), which runs diagonally across the estuary from the Argentine shore to that of Uruguay—100 kilometres, or 62 miles—along the line where the meeting of the tidal with the river water induces a precipitation of the sediment carried by the latter. The bottom is composed chiefly of a soft plastic clay, rendered more compact in places by a certain admixture of sand, etc. The detailed survey of the bottom had as its principal objects the location of the natural thalweg—which might be supposed to offer the best advantages for canalization, as most likely to be kept open by natural causes—and the charting of the bottom deposits according to their character, as this too would be of great importance in the selection of a suitable trace. During the operations seventy-six lines of soundings were run, with seven thousand individual determinations, and the result permitted the establishment of a provisional trace across the bar, 80 kilometres (50 miles) in length, between the 26-foot contour-lines on each side; this being the depth fixed upon in the first instance for the new channel. The proposed route was buoyed, and the concentration of navigation on this particular line was found to have a beneficial effect on the depth, the mud being loosened by the passage of vessels, and so more readily carried away by currents. The dredging experiments have since shown the feasibility of proceeding by the method of suction, and have already led to no small progress in the actual work. On the basis of a depth of 26 feet, a bottom width of 330 feet, and a gradient of 1 in 250 at the sides, the total volume of material to be excavated is reckoned at 47 odd million cubic metres, of which 35 million have already been removed. A gradual further deepening will be proceeded with, with a view of providing eventually a 30-foot channel, if possible.

AUSTRALASIA AND PACIFIC ISLANDS.

Prof. W. M. Davis's Researches on Coral Reefs in the Pacific.—We have already alluded to Prof. Davis's return from a successful expedition to the Pacific for the study of coral reefs, carried out with the support of the Shaler Memorial Fund of Harvard University, and with the further aid of a grant from the British Association. A preliminary report on the results of his investigations has now appeared both in the United States (*Science*, March 26, 1915) and in this country (*Nature*, April 15; the report being here prefaced by remarks signed "J. W. J."). Prof. Davis undertook the study in the belief that certain lines of evidence—and these by far the most important—had been too much neglected by students of the subject, and he therefore devoted special attention to them. Of the many theories put forward in explanation of the origin of coral reefs, any one, he points out, will satisfactorily account for the visible features of sea-level reefs themselves, and the study of these alone cannot lead to any valid conclusions. Independent evidence must be sought, and it can be readily obtained only by a study of the central islands within oceanic barrier reefs, or of massive elevated reefs such as occur in certain of the Fiji islands. Both, in his view, afford strong confirmation of the correctness of Darwin's theory of subsidence—the former from the embayments in their shore-lines to be seen in hundreds of cases, which, as Dana long ago pointed out, can only have been produced by subsidence; the latter from the relation of the limestones to the eroded surface of the pre-existent foundation. This must have stood above sea-level before the reef was deposited on it, and must have subsided to receive its marine cover. All theories of barrier reefs which involve a fixed relation of the reef foundation to sea-level during the formation of the reef-mass are, Prof. Davis maintains, excluded by the evidence of submergence obtained by him; and he shows in detail how the glacial-control theory recently elaborated by Daly will not hold for such reefs. For atolls, too, the subsidence theory is by

far the most probable, as it can hardly be supposed that subsidence should occur *only* where central islands should be present to attest it, and not in the case of reefs of identical appearance, though without such central islands. It is pointed out by "J. W. J." that areas of upheaval as well as of subsidence can be clearly traced over the whole of the Pacific, the two being in some cases so strangely intermixed as to suggest the existence of a system of faults. Prof. Davis would no doubt allow that *recent* movements of elevation have taken place in many cases, but he would apparently contend that these have been subsequent to the formation of the reefs, and have no bearing on their origin.

The Hawaiian Earthquakes of 1868.—An important contribution to our knowledge of these earthquakes is made in a paper by Mr. H. O. Wood (*Bull. Seismol. Soc. of America*, vol. **4**, 1914, pp. 169–203). The earthquakes occurred after the beginning of eruptions in both Kilauea and Mauna Loa, and on this account have generally been considered of volcanic origin. The account given by Mr. Wood leaves little doubt as to the incorrectness of this conclusion. The chief characteristics of the volcanic earthquakes are that the epicentres of successive earthquakes are approximately coincident, the foci are shallow, the disturbed areas small, the main shocks begin suddenly and are of brief duration, and the after-shocks, if any, are few in number and soon over. The Hawaiian earthquakes of 1868 were very numerous, and included three (on March 28 and April 2 and 4) of great intensity. The strongest, that of April 2, which originated to the south of Hawaii, disturbed an area of about 375,000 square miles, or about the same as that of the Californian earthquake of 1906. The earthquake was thus of the first order of magnitude, and its focus must have been situated at a great depth. The number of shocks from March 29 to April 10 is estimated at more than two thousand, between three and four hundred having been felt on some days. Though in no case could the exact position of the epicentre be determined with accuracy, there is no doubt that in successive shocks the epicentre varied considerably in position. Thus, in every respect, the earthquakes differed from typical volcanic earthquakes, and agreed with true tectonic earthquakes. The interest of this conclusion lies in the close connection in time and space between important tectonic earthquakes and eruptions of two of the great Hawaiian volcanoes. Of this connection, we have a more recent example in the eruption of Sakurashima and the earthquake of January 12, 1914, in Southern Japan (see *Nature*, vol. **92**, 1914, pp. 716–717).

HISTORICAL GEOGRAPHY.

The Strait of Anian.—The much-discussed question of this strait—the old-time representative of Bering Strait before ever a European voyager had approached the region in which it is situated—is once more dealt with by Mr. Godfrey Sykes in the March number (1915) of the *Bulletin* of the American Geographical Society. Without advancing any decidedly new ideas, the paper may be useful as bringing together the main factors of the problem, and especially for its reproduction of various old maps of importance for its understanding. One or two points are, however, missed by the writer, who seems hardly acquainted with all the previous literature on the subject, especially the German contributions of the late Prof. Ruge and Herr Sandler. Like them, he rightly insists on the leading part played by the sixteenth-century cartographer Gastaldi in introducing the strait into the conceptions of geographers, and on the provenance of the name (with others associated with it) from Marco Polo's narrative. But while reproducing Gastaldi's map of Eastern Asia (1561), in which the province of "Ania" is marked in the extreme north-east of China, as well as Zaltieri's map of 1566, in which the "Strait of

Anian" is shown, he makes no mention of Gastaldi's rare tract of about 1562, in which the strait first appears by name in literature, so far as can be ascertained.* Nor does he refer to the important part played by Ramusio through his publication of Polo's text, his version having evidently been used by Gastaldi, who was closely associated with him, and prepared the maps for his famous collection of voyages.† Mr. Sykes points to the change in Gastaldi's views of the relations of Asia and America between 1550 and 1561, as shown by a comparison of his maps of those dates, and seems to imply that the separation of the two was somewhat of a new idea at the latter date. But it must be remembered that, besides the hemisphere of 1554 published by Tramezini, and reproduced with the paper (which itself has been thought possibly the work of Gastaldi), many maps of the first half of the century had shown a water passage between the two continents, running up to the far north. Such were Mercator's double cordiform map of 1538, those of Desliens, Desceliers, Munster, and others. The complete separation of America from Asia was also insisted on by Verrazzano in his report on his voyage of 1524 (cf. *Journal*, vol. 35, p. 429). Of *maps* in which the strait of Anian is shown by name, mention might have been made of the sheet from an anonymous Venice atlas reproduced by Kretschmer (possibly earlier than Zaltieri's), and that accompanying Frobisher's voyages in search of a north-west passage (1578). The latter part of the paper deals with what is really a distinct subject—the various fictitious accounts of supposed voyages into or through the waterway connecting the Atlantic with the Pacific by the north of America—those of Juan de Fuca, Maldonado, De Fonte, and others. This was, no doubt, too wide a subject to be fully dealt with in the limits of the paper, which says little of the efforts in search of a passage from the Pacific side at the latter part of the seventeenth century, or the maps in which such a waterway was drawn across Canada towards Hudson Bay.

OBITUARY.

Colonel D. M. Lumsden.

We much regret to record the death, at the comparatively early age of 64, of Colonel Dugald McTavish Lumsden, C.B., eldest son of the late Mr. James Lumsden, of Peterhead. Colonel Lumsden was best known to the public for the part which he played in the Boer war by raising, largely at his own expense, the corps of Anglo-Indian mounted infantry which bore his name, and which did such excellent service during the protracted operations from April 1900 onwards. He went out to a tea estate in Assam at the age of 22, and soon became known and popular as a first-class shot and as a keen volunteer. He became a captain in the Durrung mounted rifles in 1887, and finally took command of the F Squadron of the Assam Valley Light Horse. To geographers he was known for his journey to the Abor country in 1909 with the late Mr. Noel Williamson and the Rev. W. L. B.

* While Ruge connected Polo's Ania with Annam, Sandler saw in it a reference to the Ainos, thinking, like Gastaldi and his contemporaries, that the passage is descriptive of the countries beyond China to the north. But Yule's interpretation of the Gulf of Cheinan (on which the places in question were placed by Polo) as a supposed arm of the sea running up into the hinterland of Tonking, presents far fewer difficulties.

† It would be interesting to know whether the strait figures in the wall-maps at Venice, supposed to have been restored by Gastaldi under Ramusio's direction.

Jackman, an account of which appeared in the *Journal*, vol. **37**, p. 621. Although unsuccessful as regards its main object—the discovery of the supposed falls of the Tsangpo—it may justly be said to have given the spur for the subsequent advance in this region, culminating in the military expedition and important explorations since successfully accomplished.

Mr. J. F. Stackhouse.

Among the victims of the disaster to the *Lusitania* was Mr. J. Foster Stackhouse, whose name had been before the public a good deal during the past few years through his efforts to organize a new British Antarctic Expedition (*Journal*, vol. **42**, p. 575). Having been forced to abandon this undertaking, he had latterly taken up the project of an expedition for oceanographic research, and had spent some months in the United States endeavouring to obtain support for it in that country. He had had some experience of polar travel through voyages to Spitsbergen and neighbouring parts of the Arctic Regions, and a short account of a trip to Jan Mayen was given in the *Journal*, vol. **39**, p. 79.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Gen. = Genootschap.
Ges. = Gesellschaft.
I. = Institute, Institution.
Int. = International.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.(k.) = kaiserlich (und königlich).
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Glaciology. *La G.* (*I.G. De Agostini*) **2** (1914): 282–293. **Novarese.**
Ghiacciai quaternari delle Alpi occidentali. By Vittorio Novarese. *Maps and Illustrations.*

Alps—Valleys. *La G.* (*I.G. De Agostini*) **2** (1914): 294–303. **Patrini.**
Contributo allo studio orogenetico di alcune valli prealpine. By Plinio Patrini. *Illustrations.*

Europe—Political. **Toynbee.**
Nationality and the War. By Arnold J. Toynbee. London: J. M. Dent & Sons, 1915. Size 8½ × 5½, pp. x. and 522. *Maps. Price 7s. 6d. Presented.*

France—Alps. **Bénévent.**
Recueil Travaux I.G. Alpine (*Univ. Grenoble*) **3** (1915): 69–100.
Le Manival (Etude de cône de déjection). Par E. Bénévent. *Illustrations.*

France—Ariège. **Reynier.**
Recueil Travaux I.G. Alpine (*Univ. Grenoble*) **3** (1915): 1–56.
La région Privadoise (Ouvèze et Payre). Par Elie Reynier. *Illustrations.*

France—Basses Alpes. **Blanchard.**
Recueil Travaux I.G. Alpine (*Univ. Grenoble*) **3** (1915): 57–67.
L'Hydrographie du Bassin superieur du Verdon. Par Raoul Blanchard.

France—Savoy. **Gaillard.**
Les Alpes de Savoie. (Second volume.) La frontière franco-italienne entre la Seigne et le Thabor. Guide pour l'alpiniste par Emile Gaillard. Macon: C. Faure. N.D. Size 7 × 4½, pp. xiv. and 326. *Maps. Price 8s.*

France—Savoy. *B.R.S.G.* (*Rome*), Ser. V., **4** (1915): 31–68, 227–275. **Giannitrapani.**
La Savoja. By Luigi Griannitrapani. *Illustrations.*
A careful piece of regional work.

Gibraltar. *J.R. Anthropological I.* **44** (1914): 264–269. **Duckworth.**
Cave Exploration at Gibraltar in 1912. By W. H. L. Duckworth. *Illustrations.*

Italy—Abruzzi. **Festa.**
Escursione Zoologiche nei Monti della Vallata del Sangro (Abruzzi). By Enrico Festa. Turin, 1915. Size 10 × 6½, pp. 12. *Illustrations.*
The illustrations (from photographs) give a good idea of the morphology of the district.

Italy—Anthropogeography. *Mem. Geografiche* **8** (1914) No. 26: 295–461. **Gasperi.**
Studi sulle sedi e abitazioni umane in Italia. I. Le Casère del Friuli. By G. B. de Gasperi. *Illustrations.*

Italy—Calabria—Historical. **Douglas.**
Old Calabria. By Norman Douglas. London: Martin Secker, 1915. Size 9½ × 6, pp. vi. and 352. *Illustrations. Price 15s. net.*

Italy—Glaciology. ———
Società Italiana per il Progresso delle Scienze, Bollettino del Comitato glaciologico italiano (sotto gli auspici del C.A.I. e della S.I.P.S.). Num. 1. Rome, 1914. Size 10½ × 7½, pp. 113. *Map and Illustrations.*
A valuable new publication, giving results of survey and observation in various groups of Italian glaciers.

Italy—Northern Plain. **Lorenzi.**
G. Riv. Italiana **21** (1914): 269–354, 401–450, 497–530, 576–604.
Studi sui tipi antropogeografici della pianura padana. By Arrigo Lorenzi. *Illustrations.*

Italy—Sardinia—Population. **Anfossi.**
B.R.S.G. (*Rome*), Serie V., **4** (1915): 165–195, 277–295.
Ricerche su la distribuzione della popolazione in Sardegna. By G. Anfossi. *Sketch-maps and Illustrations.*

Italy—Sicily—Erosion. *Pubbl. I.G. Fisica e Vulcanologia*, No. 2 (1915): pp. 7. **Platania.**
Marmitte dei Giganti di Erosione Marina. By Gaetano Platania. *Illustrations.*

Italy—Sicily—Etna. *Pubbl. I.G. Fisica e Vulcanologia*, No. 3 (1915): pp. 12. **Platania.**
Le Recenti Eruzioni dell' Etna. By Gaetano Platania. *Illustrations.*

Italy—Statistics. *La G.* (*I. G. De Agostini*) **2** (1915): 8 Maps. ———
Cartogrammi statistici d'Italia.
These maps show various distributions, such as those of illiteracy, the incidence of taxation, progress of the Cadastral Survey, etc., etc.

Italy—Venetia—Olive. *Riv. G. Italiana* **21** (1914): 2–45, 137–175, 204–250. **Toniolo.**
La distribuzione dell' olivo e l'estensione della provincia climatica mediterranea nel veneto occidentale. By Antonio Renato Toniolo. *Map and Illustrations.*

Poland—Place-names. *G. Teacher* **8** (1915): 5–14. **Ehrlich.**

Polish Place-names. By Ludwik Ehrlich.

Useful rules for pronunciation, followed by a long list of names with Polish spelling and its English equivalent.

Russia. **Graham.**

Russia and the World. A study of the war and a statement of the World-problems that now confront Russia and Great Britain. By Stephen Graham. London: Cassell & Co., 1915. Size 9½ × 6½, pp. xii. and 260. *Illustrations. Price* 10*s.* 6*d. net.*

Russia. **Hubback**

Russian realities. Being impressions gathered during some recent journeys in Russia. By John Hubback. London: John Lane, 1915. Size 7½ × 5, pp. xii. and 280. *Maps and Illustrations. Price* 5*s. net. Presented.*

Sweden—Geomorphology. **De Geer.**

Sveriges Geol. Undersökning, Ser. Ba. **9** (1913): pp. 24.

Beskrivning till översiktskarta över Södra Sveriges Landformer. Av Sten de Geer.

Sweden—Hydrography—Maps. **Smedberg.**

Sveriges Hufvudflodområdens officiella Kartor. Af Richard Smedberg. (Särtryck ur Flotnings-Tidskrift, H. 1 (16), 1915.) Stockholm, 1915. Size 11 × 8½, pp. 339. *Map.*

A catalogue of official maps of the principal water-systems of Sweden.

Sweden—Lule River. **Frödin.**

Årsbok Sveriges Geol. Undersökning **7**, 1913 (1914): No. 4, pp. 276.

Geografiska studier i St. Lule älvs källområde. Av John Frödin. (Ser. C, No. 257.) *Maps and Illustrations.*

Studies in the basin of the Lule River and the lakes drained by it.

Sweden—Scania. **Grönwall.**

Årsbok Sveriges Geol. Undersökning **7**, 1913 (1914): No. 1, pp. 118.

Frågan om djupborrningar i Skåne. Av K. A. Grönvall. *Maps and Illustrations.*

United Kingdom—Leicestershire. **Kelsey.**

Oxford County Histories. Leicestershire. By Charles E. Kelsey. Oxford: Clarendon Press, 1915. Size 7½ × 5, pp. 220. *Sketch-maps and Illustrations. Price* 1*s.* 6*d. net. Presented.*

United Kingdom—Nottinghamshire. *G. Teacher* **8** (1915): 16–26. **Fawcett.**

The Long Eaton District. Geographical Conditions and Problems of a Growing Industrial District. By C. B. Fawcett. *Sketch-maps.*

ASIA.

China. *G. Teacher* **8** (1915): 1–5. **Roxby.**

Some Aspects of the Geography of China. By P. M. Roxby.

China—Ngan-Hwei. *Variétés Sinologiques*, No. 40 (1914): pp. 129. **(Zi.)**

Notice Historique sur les T'Oan ou Cercles du Siu-Tcheou Fou, particulièrement sur ceux du district de Ou-Toan. Par Etienne (Zi).

China—Sechuan. *Variétes Sinologiques*, No. 43 (1915): pp. 35. **Roux.**

Carte du Se-tch'ouan Occidental levée en 1908–1910. Par François Roux. *Maps.*

China and Tibet—Exploration. **Tafel.**

Meine Tibetreise. Eine Studienfahrt durch das nordwestliche China und durch die innere Mongolei in das östliche Tibet. Von Dr. Albert Tafel. 2 vols. Berlin, 1914. Size 10 × 7, pp. (vol. 1) xii. and 352; (vol. 2), 346. *Maps, Illustrations, and Sections. Price* 21*s.* 6*d.*

Chinese Turkestan. **British Museum.**

Guide to an Exhibition of Paintings, Manuscripts, and other Archæological Objects collected by Sir Aurel Stein, K.C.I.E., in Chinese Turkestan. London, 1914. Size 8½ × 5½, pp. 58. *Map.*

Eastern Asia—Guides.

Official guides to Eastern Asia. Vol. 1. Manchuria and Chōsen (pp. 350). Vol. 2. South-Western Japan (pp. 370). Vol. 3. North-Eastern Japan (pp. 488). Tokyo: The Imperial Japanese Government Railways, 1913–14. Size 6½ × 4½. *Maps, Plans, Diagrams, and Illustrations. Presented.*

India—Economic. *B. American G.S.* **47** (1915): 81–99. **Packard.**

Response to Rainfall in India. By Leonard O. Packard. *Maps.*

India—Himalaya—Glaciers. *Records Geol. Surv. India* **44** (1914): 280–335. **Grinlinton.**

Notes on some Glaciers of the Dhauli and Lissar Valleys, Kumaon Himalaya, September, 1912. By Captain John L. Grinlinton. *Maps and Illustrations.*

India—Musulmans. **Bourne.**

Hindustani Musulmans and Musulmans of the Eastern Punjab. By Major W. Fitz G. Bourne. Calcutta, 1914. Size 10 × 6, pp. vi. + 110. *Price Re.* 1 *or* 1*s.* 4*d.*

India—Salt deposits. *Records Geol. Surv. India* **44** (1914): 241–264. **Christie.**

Notes on the Salt Deposits of the Cis-Indus Salt Range. By W. A. K. Christie. *Illustrations.*

Japan—Alps. *Scottish G. Mag.* **31** (1915): 113–120. **Oseki.**

Some Notes on Glacial Phenomena in the North Japanese Alps. By K. Oseki. *Sketch-map and Diagrams. Also separate copy.*

Philippine Islands—Bog. *J. Ecology* **3** (1915): 24–31. **Gates.**

A Sphagnum Bog in the Tropics. By Frank C. Gates. *Illustrations.*

Philippine Islands—Luzon. *Philippine J. Sc.* **9** (1914): 391–434. **Gates.**

The Pioneer Vegetation of Taal Volcano. By Frank C. Gates. *Map and Illustrations.*

AFRICA.

British East Africa—Survey. **Williams.**

East Africa Protectorate. Survey Department. Annual Report, by Captain G. C. Williams, for the year ending March 31, 1914. Nairobi, 1914. Size 13½ × 6½, pp. 16. *Maps and Illustrations.*

French West Africa. **Joffre.**

My march to Timbuctoo. By General Joffre, with a biographical introduction by Ernest Dimnet. London: Chatto & Windus, 1915. Size 7½ × 5, pp. 170. *Sketch-map. Price* 2*s. net. Presented.*

German South-West Africa—Geology. **Versfeld.**

South African J.Sc. **11** (1915): 187–238.

The Geological structure of portions of German South-West Africa. By W. Versfeld. *Illustrations.*

Mauritius. *Scottish G. Mag.* **31** (1915): 180–185. **Waring.**

The Distribution of the Population in Mauritius. By H. E. A. Waring. *Sketch-map.*

Nigeria, Southern—Ethnology. **Talbot.**

Woman's Mysteries of a Primitive People. The Ibibios of Southern Nigeria. By D. Amaury Talbot. London: Cassell & Co., 1915. Size 9½ × 6½, pp. 252. *Illustrations. Price* 10*s.* 6*d. net. Presented.*

Sahara—Tuareg. *J.R. Anthropological I.* **44** (1914): 351–375. **Zeltner.**

Les Touareg du Sud. Par Fr. de Zeltner. *Illustrations.*

South Africa and Indian Ocean. *South African J. Sc.* **11** (1915): 169–179. **Schwarz.**

The lost land of Agulhas. By E. H. L. Schwarz. *Sketch-maps.*

Will be noticed in the next number.

Tripoli. **Franchetti.**

La missione Franchetti in Tripolitania. (Il Gebèl.) By Leopoldo Franchetti and others. Florence: Fratelli Treves, 1914. Size 10 × 6½, pp. 610. *Maps and Illustrations. Price* 15*s.*

An important publication, giving the results of studies of the geology, water supply, agriculture, and other economic resources of Tripoli.

Place-names.

Norme per la trascrizione Italiana e la grafia Araba dei nomi propri geografici

della Tripolitania e della Cirenaica. (Ministero delle Colonie.) Rome: C. de Luigi, 1915. Size 9 × 6½, pp. 43.

NORTH AMERICA.

Alaska—Mountains. *Alpina Americana*, No. 3 (1914): pp. 22. **Brooks.**
Mountain Exploration in Alaska. By Alfred H. Brooks. *Maps and Illustrations.*

Alaska—Mt. McKinley. **Balch.**
Mount McKinley and mountain climbers' proofs. By Edwin Swift Balch. Philadelphia: Campion & Co., 1914. Size 10½ × 7, pp. 142. *Presented by the Author.*
The writer upholds Dr. Cook's claim to have reached the highest point.

Canada—Alberta. *Canada, Geol. Surv., Museum B.*, No. 4 (1914): pp. 1–36. **MacKenzie.**
The Crowsnest Volcanics. By J. D. MacKenzie. *Illustrations.*

Canada—Boundaries. **White.**
Boundary disputes and treaties. By James White. Toronto: Glasgow, Brook & Co., 1914. Size 11 × 8, pp. 750–958. *Presented.*

Canada—British Columbia. ———
Province of British Columbia. Report of the Survey Branch of the Department of Lands for the Year ending December 31, 1914. Victoria, B.C., 1915. Size 10½ × 7½, pp. 226. *Maps and Illustrations.*

Canada—Montreal. *Minutes P.I. Civil Engineers* 198 (1915): 104–207. **Cowie.**
The Transportation Problem in Canada, and Montreal Harbour. By F. W. Cowie. *Map, Plan, and Diagrams.*

Canada—Montreal. **[Ross, Robertson, Labelle.]**
The Harbour of Montreal. Annual Report, 1914. [Montreal, 1915.] Size 9 × 6, pp. 121. *Plan and Illustrations.*

Canada—Place-names. *T.R.S. Canada* 8 (1914): 259–293. **Ganong.**
An Organization of the Scientific Investigation of the Indian Place-nomenclature of the Maritime Provinces of Canada. By W. F. Ganong. [Fourth Paper.] *Also separate Copy.*

Canada—Resources. **Department of the Interior.**
The unexploited West. A compilation of all the authentic information available at the present time as to the natural resources of the unexploited regions of Northern Canada. By Major Ernest J. Chambers. Published under the direction of F. C. C. Lynch and Hon. W. J. Roche. Ottawa: Department of the Interior, 1914. Size 10 × 6½, pp. xvi. and 362. *Sketch-maps and Illustrations.*

Canada—Saskatchewan. **Tyrrell.**
Gold on the North Saskatchewan River. By J. B. Tyrrell. (From *Bulletin Canadian Mining Inst.*, February, 1915.) [Toronto, 1915.] Size 9 × 6, pp. 68–81.

North America—Cordillera. **Daly.**
Canada, Geol. Surv., Mem. No. 38 (1912): pp. xxvii. and 1 to 546; xxvii. and 546 to 557.
Geology of the North American Cordillera at the Forty-Ninth Parallel. By Reginald Aldworth Daly. In three parts. *Illustrations and Maps (pt. 3).*

North America—Mountain-building. *J. Geology* 22 (1914): 633–654. **Blackwelder.**
A Summary of the Orogenic Epochs in the Geologic History of North America. By Eliot Blackwelder.

CENTRAL AND SOUTH AMERICA.

Bolivia—Political. ———
B. Dirección Gen. Estadística y Estudios G. 10 (1914): 193–294.
División Político-Administrativa de la República de Bolivia.

Brazil. **Bruce.**
Brazil and the Brazilians. By G. J. Bruce. London: Methuen & Co., 1915. Size 9 × 6, pp. 308. *Illustrations. Price 7s. 6d. net.*

Peru. *National G. Mag.* 27 (1915): 172–217. **Bingham.**
The Story of Macchu Picchu: The National Geographic Society—Yale University Explorations in Peru. By Hiram Bingham. *Illustrations.*

South America—Anthropogeography. **Adams.**

The Plateau Peoples of South America. An essay in Ethnic Psychology. By Alexander A. Adams. London: George Routledge, 1915. Size 7½ × 5, pp. 134. *Illustrations. Presented.*

West Indies—Lesser Antilles. *B. American G.S.* **46** (1914): 662–678. **Fewkes.**

Relations of Aboriginal Culture and Environment in the Lesser Antilles. By J. Walter Fewkes.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Northern territory. *J.R.S. Arts* **63** (1915): 386–400. **Lindsay.**

The Northern Territory of Australia. By David Lindsay. *Map.*

New Zealand—Mount Cook. **Du Faur.**

The conquest of Mount Cook and other climbs. An account of four seasons' mountaineering on the Southern Alps of New Zealand. By Freda Du Faur. London: G. Allen & Unwin, 1915. Size 11 × 7, pp. 250. *Illustrations. Price* 16*s. net.*

Combines a review of previous mountaineering work in the Mount Cook region, with an account of the author's own climbs.

MATHEMATICAL GEOGRAPHY.

Geodesy—Instrument. **Madsen and Petersen.**

Den Danske Gradmaaling, Ny Række, Hefte Nr. 14. Registrerings-apparat til Tyngdemaalingspenduler. Udgivet af V. H. O. Madsen. Beskrevet af Aage Petersen. Copenhagen, 1915. Size 10½ × 9, pp. 13. *Illustrations.* [French *résumé.*]

Sundials. **Washington.**

Calculations for Sundials. By Colonel F. P. Washington. [Type-written sheets.] Size 10 × 8. *Diagrams.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. **Huntington.**

The Solar Hypothesis of Climatic Changes. By Ellsworth Huntington. (From *B. Geol. S. America* **25** (1914): 477–590.) *Maps and Diagrams.*

Climatology. **Norlind.**

Einige Bemerkungen über das Klima der Historischen Zeit nebst einem Verzeichnis mittelalterlicher Witterungserscheinungen. Von Arnold Norlind. (*Lunds Universitets Årsskrift*, N.F., Afd. I., Bd. 10, Nr. 1.) Lund and Leipzig, 1914. Size 10 × 6½, pp. 53.

See note in the January number (1915), p. 82.

Coral reefs. *B. American G.S.* **46** (1914): 561–577, 641–654, 721–739. **Davis.**

The home study of Coral Reefs. By (Prof.) W. M. Davis.

Coral reefs. *Science*, N.S., **41** (1915): 455–458. **Davis.**

Preliminary Report on a Shaler Memorial Study of Coral Reefs. By W. M. Davis.

See note *supra*, p. 539.

Volcanism. **Iddings.**

The Problem of Volcanism. By Dr. Joseph P. Iddings. New Haven: Yale University Press (London: Humphrey Milford), 1914. Size 9½ × 6½, pp. xvi. and 274. *Illustrations and Sections. Price* 21*s. net. Presented.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology. *J.R. Anthropological I.* **44** (1914): 385–393. **Irving.**

Some recent work on Later Quaternary Geology and Anthropology, with its bearing on the Question of "Pre-Boulder-Clay Man." By A. Irving. *Illustrations.*

Economic Geography. *Scottish G. Mag.* **31** (1915): 82–93, 123–136. **Chisholm.**

Some Considerations in Economic Geography in Connection with the War. By George G. Chisholm.

History of Geography. *La G., I.G. (De Agostini)* **2** (1915): 330–348. **Almagià.**

La Geografia nell' età classica. By Roberto Almagià.

BIOGRAPHY.

Blaeu. **Stevenson.**

Willem Janszoon Blaeu, 1571–1638. A sketch of his life and work, with an especial reference to his large World Map of 1605. Facsimile of the unique copy belonging to the Hispanic Society of America. By Dr. Edward Luther Stevenson. New York: The Hispanic Society of America, 1914. Size 9½ × 6, pp. 68. *Portrait and Facsimiles. Map in separate case, size* 26 × 20½. *Presented.*

Will be reviewed in an early number.

Petermann. **Weller.**

Leben und Wirken August Petermanns. Von Dr. E. Weller. Leipzig: J. Klinkhardt, 1914. Size 10 × 6½, pp. 64. *Portrait.*

Extension of a chapter in a former work by the same author on Petermann and his School.

GENERAL.

Bibliography. **Royal Society.**

Catalogue of Scientific Papers. Fourth series (1884–1900). Compiled by the Royal Society of London. Vol. 14. C. — Fittig. Cambridge: University Press, 1815. Size 11½ × 8½, pp. 1024.

Education. *G. Teacher* 8 (1915): 43–45. **Sutherns.**

Geographical Education in South Africa. By H. D. Sutherns.

Virtually the same communication as that sent to us by Mr. James Hutcheon, summarized in the *Journal* for April, p. 338.

Education—Text-book. **Pickles.**

The surface of the Earth. Elementary, physical, and economic geography. By Herbert Pickles. Cambridge: University Press, 1915. Size 8 × 5½, pp. xii. and 170. *Sketch-maps, Illustrations, and Diagrams. Price* 2*s. Presented.*

Flags. **Gordon.**

Flags of the World. Past and present. Their story and associations. By W. J. Gordon, with illustrations by W. J. Stokoe. London: F. Warne & Co., 1915. Size 8 × 5½, pp. xvi. and 256. *Illustrations. Price* 6*s. net. Presented.*

A useful work, giving a large amount of information not easily accessible elsewhere. There are many coloured illustrations.

NEW MAPS.

By E. A. REEVES, Map-Curator, R.G.S.

EUROPE.

Europe. **Bacon.**

Bacon's New War Map of South-Central Europe (with contour colouring). Scale 1 : 2,725,000 or 1 inch to 43 stat. miles. Size 28 by 20 inches. London: G. W. Bacon & Co., Ltd., [1915]. *Price* 1*s. net. Presented by the Publishers.*

Europe. **Frater.**

Carte de la Frontière Occidentale de la Russie par le Colonel Frater. 1re Édition (1915). Scale 1 : 2,000,000 or 1 inch to 31·56 stat. miles. Size 20 by 21 inches. Paris: Librairie Militaire Chapelot, 1915.

This map is a companion to that of the western theatre of war published some months ago and noticed in the *Geographical Journal* for November last. It shows by symbols and colours: forests, marshes, railways with their relative importance, routes, fortified towns, and forts; towns are indicated by different symbols according to their population. Hill shading is in brown, and international boundaries in red. Routes and roads are all shown in the same manner, and there is no means of ascertaining their relative importance or condition.

As in the case of the previous map, a large portion of the sheet is taken up with letterpress dealing with the military geography of the Russian, German, and Austrian frontiers, the concentration of troops, and kindred subjects.

Europe. **Service Géographique de l'Armée, Paris.**

Carte du Théâtre des Operations (Front Occidental) avec Répertoire Alphabetique. Scale 1 : 500,000 or 1 inch to 7·89 stat. miles. 15 sheets, each 12 by 16 inches. Paris: Service Géographique de l'Armée, 1915.

These are the sheets of the French Depôt des Fortifications map on the 1 : 500,000

scale embracing the western theatre of war, with boundaries in red. There are no contours, but numerous heights are given in figures. The sheets are folded in a portfolio, and accompanied by a most useful and complete alphabetical index to places. Letters and figures have been added to the borders of the sheets corresponding with those given with the names in the index.

Europe. **Service Géographique de l'Armée, Paris.**

Europe 1,000,000ᵉ (1 inch to 15·78 stat. miles). Sheets: 48° N. 12° E. Milan; 48° N. 18° E. Buda Pesth; 48° N. 24° E. Bucharest; 52° N. 12° E. Munich; 52° N. 18° E. Vienne; 52° N. 24° E. Lemberg; 56° N. 12° E. Berlin; 56° N. 18° E. Dantzig; 56° N. 24° E. Varsovie. Paris: Service Géographique de l'Armée, [1915]. *Price 1.25 fr. each sheet.*

Sheets of Central Europe specially prepared for use during the present military operations. Each sheet contains four degrees of latitude and six of longitude; but in consequence of longitude being reckoned from Paris, the limiting meridians of these sheets are not the same as those of the 1 : 1,000,000 International Map of the World. The style of production resembles generally that of the Balkan map on the same scale, and others of the series that have been previously published. No attempt has been made to give contours, and relief is indicated by hill-shading in brown, with numerous heights in figures. Railways are in black, roads in red, and rivers blue. There is no explanation of the symbols employed. Considerable detail is shown, and there is a large number of place-names—perhaps too many for clearness. Each sheet is separately projected, but the projection selected is hardly satisfactory for the purpose. It is in effect the straight-lined trapeziform projection upon which some of the maps in the early editions of Ptolemy were constructed. Whatever may be said in its favour for a single sheet of a small area, it is quite unsuitable when it is desired to join several sheets, because at the corners the meridians are far from being at right angles to the parallels.

Europe. **E. Stanford.**

The Theatre of War in Eastern Europe. Stanford's War Maps, No. 11. Scale 1 : 1,140,000 or 1 inch to 18 stat. miles. Size 43 by 28 inches. London: Edward Standford, Ltd., 1915. *Price 7s. 6d. Presented by the Publishers.*

A clear and useful map for following the military operations in the eastern theatre of war. Railways and roads, with their relative importance, canals, and a careful selection of towns and villages are given. The general land relief is well brought out by tints in brown at the following intervals in feet: 0 to 500; 500–1000, 1000–2000, 2000–5000, and above 5000. Care has been taken to indicate important passes clearly.

Europe **Vida de lablache.**

Carte Murale du Théâtre de la Guerre Européenne par P. Vida de lablache. Scale 1 : 1,500,000 or 1 inch to 23·67 stat. miles. Size 36 by 48 inches. Paris: Armand Colin, 1915.

A diagrammatic map showing the eastern and western theatres of war with the relief, principal railways, canals, rivers, and chief towns in a bold style so that they can be seen several feet away. Less important detail and place-names are small and only legible on close inspection. Forts are shown by a special symbol, and the camps of prisoners of war in Germany are underlined. The Balkan States are shown as an inset.

France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets, new editions, 1914: vi.–16, Pontivy; vi.–19, Belle-Ile (Est); x.–25, Rochefort; xiii.–18, Château-du-Loir; xiv.–10, Pavilly; xiv.–12, Evreux; xiv.–22, Le Blanc; xvi.–13, Paris (Ouest); xvi.–19, Salbris; xvi.–26, Ussel; xvi.–28, Mauriac; xvii.–37, St. Paul; xviii.–14, Provins; xviii.–26, Issoire; xix.–7, Valenciennes; xix.–25, Thiers; xxi.–25, Lyon (Nord-Ouest); xxiv.–21, Salins; xxiv.–25, Annecy; xxiv.–30, Gap; xxv.–15, Baccarat; xxvi.–24, Vallorcine. Size 13 by 17 inches. Paris: Hachette & Cie.

Sweden. **Sveriges Geologiska Undersökning.**

Geologisk Karta över Sverige. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheet iv. 0. 36, Gamleby. Size 18 by 24 inches. Stockholm: Sveriges Geologiska Undersökning, 1915. *Presented by the Swedish Geological Institute.*

Switzerland. **Kummerly and Frey.**

Offizielle Eisenbahnkarte der Schweiz. Stand auf 1. Januar 1915. Scale 1 : 500,000 or 1 inch to 7·89 stat. miles. Size 20 by 29 inches. Bern: Kümmerly & Frey, 1915.

A new edition of an official map showing Swiss railways up to January 1, 1915.

By various colours and symbols a considerable amount of information is given concerning the railways, but by some oversight the coloured symbols are omitted in the reference, there being only blank spaces instead.

Turkey. **E. Stanford.**

Stanford's War Maps, No. 12. The Theatre of War in Western Asia Minor, the Sea of Marmora, the Bosporus and Dardanelles, Constantinople, and Smyrna. Size 18 by 28 inches. London: Edward Stanford, Ltd., 1915

A sheet containing seven coloured maps and plans on different scales.

AMERICA.

Canada. **Dept. of the Interior, Ottawa.**

Map showing Elevators in Manitoba, Saskatchewan, and Alberta. Prepared in the Railway Lands Branch, F. C. C. Lynch, Superintendent. Scale 1: 1,584,000 or 1 inch to 25 stat. miles. Size 16 by 35 inches. Ottawa: Department of the Interior, 1915. *Presented by the Department of the Interior, Ottawa.*

Canada—British Columbia. **Dept. of Mines, Ottawa.**

Geological Survey of Canada. Scale 1: 62,500 or 1·014 inch to 1 stat. mile. Maps: 70A, Victoria, Vancouver Island; 72A, Saanich, Vancouver Island. Size 18 by 12 inches. Ottawa: Department of Mines, 1914. *Presented by the Department of Mines, Ottawa.*

United States. **Renshawe.**

Panoramic View of the Yellowstone National Park, Wyoming-Montana-Idaho. Prepared by John H. Renshawe from Topographic Sheets of the United States Geological Survey. Scale 1: 187,500 or 1 inch to 2·9 stat. miles. Size 21 by 18 inches. Washington: Department of the Interior, [1915]. *Presented by the Department of the Interior, Washington.*

A graphic but somewhat roughly executed relief map, printed in colours, giving much the effect of a map taken from a model of the district.

AUSTRALIA.

Australia. **Hunt.**

Map showing average rainfall for the wheat-growing period April to October inclusive, also percentage of average annual rainfall during the same period over Australia and Tasmania. Scale 1: 12,672,000 or 1 inch to 200 stat. miles. Size 8 by 10 inches.—Frost Map of Australia. Scale 1: 12,672,000 or 1 to 200 stat. miles. Size 8 by 10 inches. Issued under the authority of the Minister of State for Home Affairs by H. A. Hunt, Commonwealth Meteorologist, 1914.

Victoria. **Geological Survey of Victoria.**

Geological Survey of Victoria. Scale 1: 31,680 or 2 inches to 1 stat. mile. Sheets: Bullioh, size 10 by 12 inches; Bungil East, size 18 by 12 inches. Melbourne: Geological Survey of Victoria, 1915. *Presented by the Geological Survey of Victoria.*

WORLD.

World. **Bacon.**

New Series of Physical Wall Atlases. The series comprises seven complete atlases as follows: Europe, scale 1: 8,000,000 or 1 inch to 126 stat. miles; Asia, scale 1: 16,000,000 or 1 inch to 259 stat. miles; Africa, scale 1: 12,500,000 or 1 inch to 197 stat. miles; North America, scale 1: 12,500,000 or 1 inch to 197 stat. miles; South America, scale 1: 12,500,000 or 1 inch to 197 stat. miles; Australia, scale 1: 4,600,000 or 1 inch to 75 stat. miles; World in Hemispheres, approximate scale 1: 39,000,000 or 1 inch to 616 stat. miles. London: G. W. Bacon & Co., Ltd., [1915]. *Price of the seven maps forming each atlas, mounted,* 21*s*. *Presented by the Publishers.*

With the more enlightened and scientific methods of teaching and studying geography there follows naturally an increasing demand for suitable appliances, amongst the important of which are maps and atlases. Geographical publishers in this country have already done much to meet the need, and several series of school wall maps on more or less approved lines are already obtainable. The series mentioned above is the latest of these, and consists of seven sets of wall maps, or atlases as they are called, of the World in hemispheres, Europe, Asia, Africa, North America, South America, and Australia. Each set comprises seven maps dealing with the following subjects: (1) contours, (2) vegetation, (3) rainfall (mean annual), (4) rainfall (seasonal), (5) isotherms (January), (6) isotherms (July), and (7) commercial. All the maps measure

about 31 by 38 inches, and those of any one region are on the same scale. The outlines are simple, and on the whole clear; and upon these, principally by means of colour-tinting, are shown the special information and features dealt with. Care has been taken not to overcrowd the maps, and only those names that are essential are given. In some instances there is hardly enough distinction between the colours and tints selected, and in the case of the isothermal maps it would certainly have been an advantage to have shown the isothermal lines in addition to the tinting. Evident pains has been taken with the maps, and there is no doubt they will prove useful; but as wall maps some of the work is hardly bold enough to be clearly seen at a distance, although in a small class-room there may not be much difficulty in this respect. Very properly, where comparison of areas is concerned, equal-area projections have been used for the maps, Bonne's for Europe, and the Zenithal (Lambert's) for the others. There is, however, one exception to this rule, that of Australia, which is drawn on Clarke's Minimum Error Perspective Projection. This is an excellent projection for a region like Australia, and gives a good general representation of the continent; but it is not equal areal. The general idea and scheme of this series of maps is much the same as that of at least two other sets that have been published in recent years, and which have been much appreciated by teachers.

World. **Bacon.**

Bacon's Contour Atlas: North England Edition; Lancashire and Yorkshire Edition; Southern Wales Edition. Size 9½ by 7½ inches. London: G. W. Bacon & Co., Ltd., [1915]. *Price 6d. each. Presented by the Publishers.*

Three of a series of cheap school atlases each containing thirty-seven maps, showing relief by coloured layers system, and distribution of natural phenomena by various tints, with an index at the end giving the latitudes and longitudes of principal towns. The atlases are all similar except that at the commencement there are a few special maps dealing particularly with the districts named.

CHARTS.

Polar Regions. **Soley.**

Currents in the Arctic and Antarctic Regions with attention to water temperatures, colour and formation of ice, and other physical conditions. By Lieut. John C. Soley, U.S. Navy (Retired), in charge of the Branch Hydrographic Office at New Orleans, [1915]. Size 26 by 36 inches. *Presented by Lieut. John C. Soley, U.S. Navy (Retired).*

Charts of the Arctic and Antarctic regions on one sheet, with text below describing generally the physical conditions, currents, water temperatures, and ice formation and coloration. The Arctic chart extends to the 65th, and the Antarctic to the 50th parallel of latitude.

PHOTOGRAPHS.

Asia. **Romanoff.**

Ten photographs of Persia, Caucasus, and Russian Turkestan by Nicolas Romanoff. *Presented by M. Nicolas Romanoff*, 1914.

Excellent enlargements varying in size from 11¾ by 9¾ inches to 14 by 7½ inches, recently exhibited in the Society's Photograph Room. The specimens of architecture, if not entirely geographical, are very interesting and remarkably good.

(1) Palace and gardens of governors of Astrabad, time of Mohammed Agha, 1810; (2) Mosque in Astrabad; (3) Entrance to mosque in Astrabad; (4) Old shrine in Astrabad, carved wood doors, twelfth century; (5) Teheran entrance gate, October, 1913; (6) Teheran, view in bazaar; (7) Shrine, Elisabetpol, Caucasus region; (8) Shrine in Khojent, Russian Turkestan; (9 and 10) Panthers, Persia.

Dolomites. **Torday.**

One hundred and nineteen photographs of the Schlern Dolomites, taken by E. Torday, 1914. *Presented by E. Torday, Esq.*

These photographs are of various sizes from some quite small ones of about 3¾ by 2¾ inches to panoramas of 11½ by 3½ inches. They serve well to illustrate the characteristic features of this district of the southern Tyrol.

(1, 3, 5, 6, and 7) Völs, Schlern; (2) Völs, from the Schlern; (4) Near Völs; (8) A peasant near Völs; (9, 10, 11, and 12), Völs fish-pond; (13) Atzwang; (14) Atzwang, on the river Eisach; (15 and 16) Near Atzwang; (17, 21, and 30) View from St. Constantin; (18) Road from St. Constantin to Atzwang; (19) St. Constantin with Ritten in background; (20) On the road from Waidbruck to St. Constantin; (22, 27) St. Constantin; (23) Between St. Constantin and Völs; (24) Road of avalanche near St. Constantin; (25) The road at St. Constantin; (26) Road from St. Constantin to Umst; (28)

near St. Constantin; (29) The Schlern from the road between St. Constantin and Umst; (31) Road to Gröden from St. Constantin, the mountain pass with anemones; (32) View from St. Constantin in the morning; (33) Sennhütte on the Duftalm, near St. Constantin; (34) The Aichnerin, on the steep road from St. Constantin to Atzwang; (35 and 36) Wealthy peasant woman from St. Constantin; (37) Valley of Eisach from St. Constantin; (38, 39, and 40) Valley of Eisach; (41) The castle near Waidbruck; (42) Near St. Vigil; (43, 44, 45, and 47) St. Vigil; (46) Ruine Salegg; (48, 49, 50, 51, and 52) Wolfsschlucht, Salegg; (53, 54, and 55) The Ritten; (56) Ruins of Hauenstein; (57) St. Valentin; (58, 59, and 60) Kastebruth; (61, 62, 64, and 65) Santner peak; (63) The Santner (Rosszähne on the left); (66) The Puflatsch; (67, 68) Seis; (69, 72, and 77) Near Seis; (70) From the new road up to Seis; (71) Seis, the Puflatsch in the background; (73) View from Seis; (74) Cascade near the new road to Seis; (75) Plague cemetery near Seis, the church, St. Valentin, dates from thirteenth century; (76) Sea of rocks near old road up to Seis; (78, 80, and 82) The brook Ratzes; (79) Brook Ratzes with Gschtadshof above; (81) Bridge over the Ratzes; (83) Seiser Alm (mountain-side pasture land), from brook Ratzes; (84) Mill on the Ratzes; (85) Ratzes; (86, 87, 88, and 90) St. Ulbrich; (89) In St. Ulbrich; (91 and 92) St. Christine; (93) Wolkenstein; (94) Castle, Wolkenstein; (95, 96, and 97) Langkoffel; (98 and 100) Ruin of Castle Aichau; (99) Aichau; (101) Aichau (left) and St. Vigil (right); (102, 103) Prösels; (104) Prösels, with old watch tower; (105) Castle Prösels; (106) Castle of Count Colonna at Prösels; (107) Edelsitz Zimmerlehn; (108) Back from church (near Zimmerlehn); (109, 110) Umst; (111) Schlern; (112) The Schlern; (113) The Schlern under a cloud; (114) Calvary on the Schlern; (115) View from the tunnel on the new road, Schlern; (116) Above the Duftalpe, Schlern; (117) The pass to Gröden; (118) Woman in Gröden; (119) Wood-carver.

Sikkim and Tibet. **Noel.**

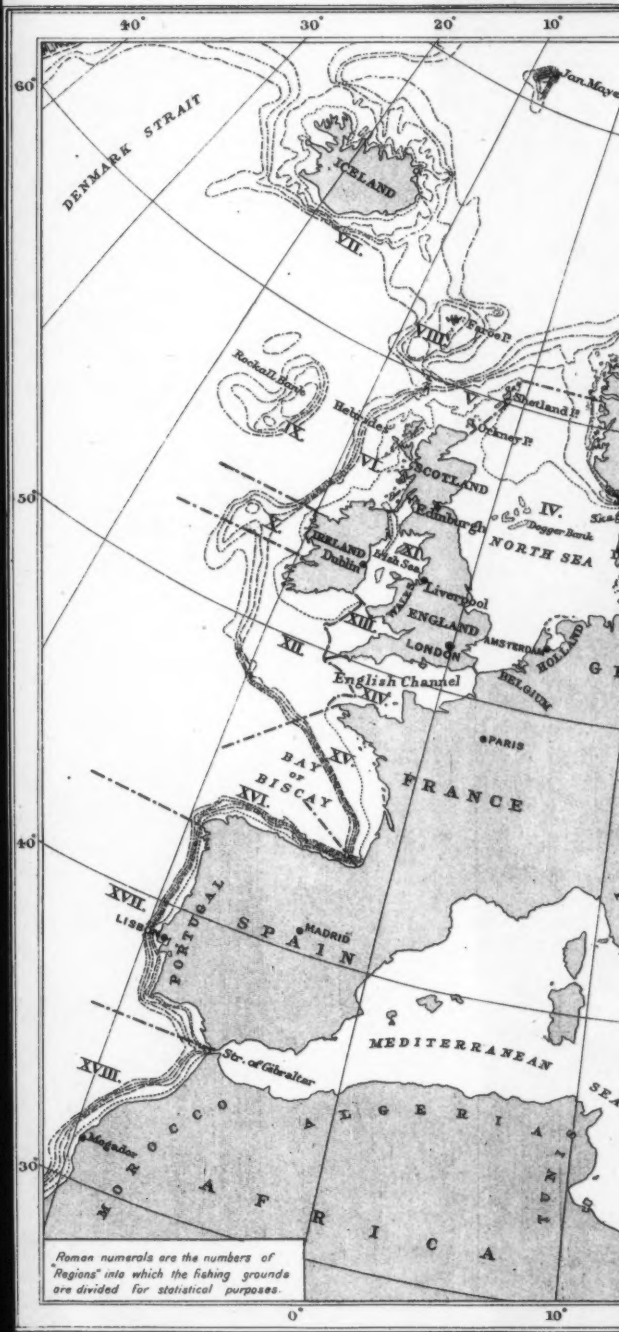
Album of forty photographs illustrating a journey to Tashirak in Southern Tibet, undertaken in 1913 with the object of exploring the eastern approaches to Mount Everest; also some photographs of Kangchenjunga and the Zemu glacier, taken by Lieut. J. B. L. Noel, 1913. *Presented by Lieut. J. B. L. Noel.*

These photographs are of special importance inasmuch as the route followed is but little known, and in many cases they are quite unique. They measure 4 by 3 inches, and are extremely good and clear. Lieut. Noel has carefully described them and mounted them in an album; he has further added to their value for reference by giving at the end a sketch-map of the route showing the places where they were taken.

(1) In the Terai, between Siliguir and Sivook; (2) Typical scenery on the Teesta Valley road, Darjeeling district; (3) Rungpoo, Sikkim frontier post; (4) Gangtok, with the Raja's palace on the hill; (5) Dikchu, Raitadong; (6) Thangu, the last bungalow, 12,800 feet; (7) The Lugnak La from Thangu, giant rhododendron in the foreground; (8) Camp at Mugu thang, Lhonak: the Thé La in the background; (9) The Naku Valley and Chumiumo, Lhonak; (10) Tebli and Chumiumo, Lhonak; (11) Lake on the summit of the Naku La; (12) Fording the Naku chu; (13) Expedition fording the Langpoo chu, Lhonak, on the way up to Zanak; (14) The Goraphu Valley, Lhonak; (15) The Chorten-Nymma La, coolies in the foreground; (16) On the summit of the Chorten-Nyuma La; (17) The desert from the Chorten-Nymma La; (18) Country round Chorten-Nymm entrance to the valley leading to the pass on the right; (19) Chorten-Nymm monastery, Tibet; (20) Mugh village, Tibet; (21) The rock-hewn village of Changmoo, Tibet; (22) Camp at Mugh; (23) The view from the summit of the Langboo La, looking west; (24) Tashirak; (25) Tashirak, showing the frontier wall; (26) Valley below Tashirak leading up to the south side of the peak Taringban; (27) Two lamas at Guma village; (28) The Dzong-Pen of Khampa Dzong; (29) Two Tibetan women; (30) Woodcutters' huts in the Zemu forest; (31) The natural bridge below the Zemu glacier; (32) Striking camp in the early morning below Siniolchum on the Zemu glacier; (33) The Sugar Loaf from below Green Lake; (34) Simvu and Green Lake, Zemu glacier; (35) Siniolchum; (36) Siniolchum and Little Siniolchum from Green Lake; (37) North-west ridge of Siniolchum; (38) The Tent Peak, Tent Peak Pass and Green Lake glacier; (39) The 19,000-feet gap, Kangchenjunga; (40) Kangchenjunga from the head of the Zemu glacier.

N.B.—It would greatly add to the value of the collection of Photographs which have been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

Map showing the FISHING GROUNDS
to illustrate the
PROF. J. STANLEY G



Scale 1: 25,000,000 or 1 Inch
500 400 300 200 100 0

Published by the Royal Geograph

OUNDS frequented by British Trawlers
ate the paper by
LEY GARDINER, F.R.S.

0 or 1 Inch = 395 Stat. Miles.
0 500

FISHING GROUNDS
GARDINER.

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